

The Belize Ag Report

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May 2017
ISSUE 36



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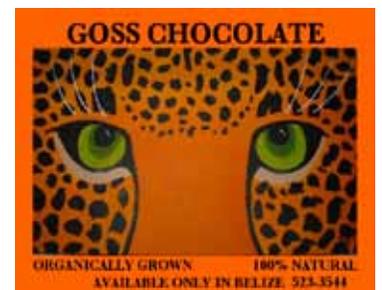
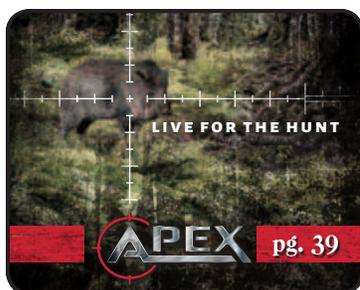
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GOD BUSH CONTROL PROGRAM IN CITRUS

Edwin Gomez, Raymond Arnold, David Saravia.

INTRODUCTION

Struthanthus orbicularis is one of the various parasitic weed that reproduces on citrus in Belize. Most commonly known as God bush or “Mata Palo” in Spanish. God bush can be reproduced by seeds and plant tissues, the spread from tree to tree is mainly by birds, human and farm machinery. Inadequate management of God bush forces trees to compete for sunlight, water, and nutrients. The growth aggressiveness of God bush can cover trees foliage rapidly causing an ideal micro climate within trees suitable for fungal diseases, subsequently leaf drop, die back of branches and final death of trees.

Chemical control methods for God bush has damaged trees if sprayed direct, most common method implemented to control have been pruning of infested branches.

A herbicide trial was conducted to control *S. orbicularis* on orange trees at Cool Shade, Cayo District, Belize C.A. from the 18th January to 7th April, 2017.

OBJECTIVE

1. Evaluate herbicides combination to control God bush. 2. Evaluate application method and damage to tree. 3. Develop cost per herbicide mixture analysis for best control.

METHODS

Select trees infested with God bush. 2. Label trees to be applied with herbicide mixtures. 3. Calibration of application equipment. 4. Mix recommended herbicide dosages based on product technical sheet. 5. Label trees per products used; **Trial 1** Dash 37.5 EC, Tribel 48 EC, Totem 72 SL and Heat 70 WG, **Trial 2** Dash 37.5 EC, Tribel 48 EC and Totem 72 SL, **Trial**

3, Dash 37.5 EC, Tribel 48 and Heat 70 WG .6. Application of herbicide mixtures with the use of a brush direct to God bush on trees. 7. Record application and follow up dates for observations.

RESULTS:

Application day



15 days after application



OBSERVATION/CONCLUSIONS

From list of herbicides used, best result to control God bush were obtained in Trial 3 with no returning of the weed after 80 days of application (Table 1.1 shows cost per litre of herbicide mixture)

After complete death of God bush regrowth of leaves were observed followed by flowering

It is not recommended to apply none of the herbicide mixtures used in this trial direct to trees with sprayers.

Table 1.1 Cost analysis for herbicide mixture with best results

TRIAL 3 COST PER LITRE OF MIXTURE ANALYSIS				
PRODUCT	PRESENTATION	UNIT COST	DOSAGE	COST
Dash 37.5 EC	1000	\$ 17.00	10	\$0.17
Tribel 48 EC	1000	\$ 47.03	2	\$0.09
Heat 70 WG	150	\$ 98.75	0.15	\$0.10
TOTAL				\$ 0.36

Old Crops Become New Underutilized Native Crops Sweet Potatoes By Santiago Juan



The problem in food shortage, even with the technology that has been developed over the decades, continues to rise. In 1975 the deficit in food availability worldwide was 12 million metric tons; in the 1990's it had surpassed 85 million metric tons. Today it is closer to 100 million metric tons.

The crops with the most acreage or tonnage produced in the world are wheat, rice, corn, potatoes and sweet potatoes,

presented in order of importance. Of the aforementioned crops, sweet potatoes have achieved the highest yields per acre in farm trials. Of all the roots and tubers consumed in the world sweet potatoes take second place just behind potatoes. Approximately 46 million acres of potatoes are produced in the world and about 34 million acres of sweet potatoes. Asia grows 92 percent of the total acreage of sweet potatoes. It is one of the few crops that can be grown from sea level up to 6000 feet about sea level.

The sweet potato plays an important role in the world food supply, but we have not utilized it in Latin America to its fullest potential even though we have the ideal growing conditions. It is not surprising that it was domesticated in Central and South America and utilized by the indigenous people of this region. It was not until the voyages of Europeans to the Americas that it was introduced into other parts of the world.

The current system of agriculture is based on agro-chemicals for the control of insect pests, weeds and other bacterial and fungal problems that are present in the large-scale agriculture models around the world. Herbicides are one of the most utilized of all agro-chemicals as it is a general practice to keep the fields free of weeds and the ground exposed. As a consequence, soils around the world are being degraded not only due to the fact that herbicides have a direct effect on soil degradation but also due to erosion, minimization of plant diversity and soil flora and fauna.

The indiscriminate use of agro-chemicals and the consequent soil, water, air and inevitably food contamination has pushed us to revise our agricultural methods and rethink how food is to be produced to meet our needs. So, few of us have posed the questions:

- 1) What is the cost/benefit relationship of the use of agro-chemicals, in relation to providing safe and clean food and protecting our soils as a resource?
- 2) What is the economic threshold of the different agricultural crops in relation to weed populations and the effect on final yields?

Based on these two questions sweet potato is among one of the handful of crops that can assist us in the goal of providing safe food, not only plant-based but also animal-based.

The sweet potato plant is divided into three parts, each having its unique function. Over the ground the photosynthetic area absorbs energy from the sun in the form of light and converts it through a chemical process to carbon compounds; the vines transport this energy to the root system. Below the surface of the ground the root system absorbs water and nutrients and functions as "acreage" for the above growing parts; furthermore it stores all the excess energy that is not utilized for growth. The storage is made in the form of carbohydrates in the roots which expand and eventually it is what we eat. Sweet potato is not a tuber but a root.

In Central America all parts of the plant are utilized. The leaves and vines are harvested for feeding pigs, backyard chickens and ducks. In China and the Philippines, the young tips are just as important as the roots in everyday cooking.

The plant can be grown in a very wide range of soil types and can also persist in very dry conditions making it a favorite for small farmers. It is a crop that also adopts well under organic farming systems. The economic threshold of insect damage is 30 percent and the weed population can be up to 40 percent without impacting total yield. From planting to harvest for most varieties it is between three and five months. The tips are ready to start harvesting just six weeks after plating during the rainy periods. Thirty percent of the growing tips and vines can be harvested without having a negative effect on the total root yield. Feeding harvested vines to pigs greatly reduces the cost of production. Once the roots have reached maturity they can be left in the ground and harvested as needed by the family. They are as versatile in cooking styles as the Irish potato.

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TO THE EDITOR

Dear Editor:

I am writing to share the importance of the visit we had by Dr. Stephanie Seneff, MIT scientist, who presented to the Pesticides Control Board and the general public, "Why Glyphosate Should Be Banned, Globally."

Representatives for seven sponsoring organizations including Belize Organic Family Farming, Pro-Organic Belize, Belize Wellness Institute, Belize Botanical Gardens, Plenty Belize, Sustainable Harvest International of Belize, and Southeast Watershed Alliance Group (SWAG) made presentations to the Pesticides Control Board Review Committee on August 30, 2016 requesting the PCB review and prohibit the importation of glyphosate, and all its formulations (some 19) currently imported into Belize. We were instructed to base our presentations on peer-reviewed studies. This means that a group of scientists must vet the science behind the study, and deem it to be based on scientific fact.

Despite working independently, both groups referenced information from Dr. Stephanie Seneff's work, because she is a brilliant scientist, who collaborates with a number of leading scientists, to show that the high correlation between the rise in incidents of many major diseases and the increased use of glyphosate cannot be ignored. With p-value significant levels less than 0.00001, she quoted Dr. N. Swanson, who did the correlations, as saying, "It would be imprudent not to consider causation as a plausible explanation."

Major factors to consider about glyphosate include:

1. Glyphosate is an organophosphate, a man-made amino acid that mimics glycine, an essential amino acid. It is theorized that the body may utilize glyphosate molecules, or its metabolite "AMPA" in place of glycine, causing degradation, and impairing function at the cellular level.
2. Although glyphosate is an herbicide and kills plants that have not been genetically modified to resist it, it produces teratogenic effects (birth defects) on vertebrates and destroys the environment causing death to sea life, birds, butterflies and honeybees among others and pollutes the water that we use and drink.
3. Through the Freedom of Information Act Gary Gillam obtained documents showing that glyphosate producer, Monsanto, wrote papers themselves and paid scientists to claim authorship of its claims that glyphosate is "harmless"; furthermore Monsanto tries to destroy the careers of scientists who prove and write about the harmful effects of glyphosate and ostracizes those who produce new scientific proof of its harmful effects while basing its claims that glyphosate is "safe to consume" on faulty non-peer-reviewed studies.

We say:

- » Belize has a duty as per the National Integrated Water Resources Management Policy to provide safe potable water for the people of Belize..
- » Belize has a duty as per the Food Safety Act Cap 211, "responsibility for monitoring, inspecting, approving and controlling food safety systems in respect of all enterprises (including all land-based processing enterprises and all sea-based processing enterprises) that produce or process food for export from Belize or for consumption within Belize.
- » Belize has a duty under the Pesticides Control Act, Cap 216 to prohibit dangerous pesticides; "prohibited pesticide" means any pesticide of which the possible effects on the environment, plants, animals or human beings are considered by the Minister to be too dangerous to justify its use.

- » Belize has a duty by convention to protect our World Heritage Belize Barrier Reef System.

We call on BAHA as the agency mandated with this duty, to work with our combined sponsoring organizations to see that the monitoring and testing of samples is implemented as soon as possible, as BAHA has the equipment to detect glyphosate and other pesticides, but needs supplies to make the system functional.

We ask the people of Belize to insist that a functional monitoring and sampling system be set in place.

Hyacinth Ysaguirre
Coordinator
Southeastern Watershed Alliance Group
653-0493
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Dear Editor,

I have a client in Toronto Canada looking for a supply of breadfruit flour for his pasta and bakery clients.

I've encountered breadfruit many times in Belize but not a commercial producer or a BF flour mill.

Do you know of any large producers who either have a mill or would like to, BF flour is becoming popular in North America due to being gluten-free.

My client may be interested in funding a mill if sufficient supply is available.

Please advise, Thank You.

Best Regards,
W.C. (Bill) Jolliffe
Bill@Zubacorp.com



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Mission Statement:

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

The Belize Ag Report, P.O. Box 150, San Ignacio, Cayo District, Belize, Central America
Telephone: 663-6777 (*please, no text, no voicemail*)
Editors: Beth Roberson and Dottie Feucht
Associate: Sally Thackery
Publisher: Beth Roberson
Printed by BRC Printing, Benque Viejo, Cayo District, Belize
Submissions as follows:
Letters to the Editor, Ads & Articles to:
belizeagreport@gmail.com
Deadlines for submissions: 1st of the month prior to publication. 4 Issues per year

Update on Missouri farmer, J.R. Bollinger of Missouri, USA: See Carbon-Smart Corn article, Issue #34, November 2016.

We have some news about farmer, J.R. Bollinger of Missouri, USA, whose biological methods for large-scale farming were the subject of the *Carbon-Smart Corn* article, reprinted from *Acres USA* magazine, in our November 2016 Issue #34 (pg 5). This article's length greatly exceeded our usual article size, but because it was so nutrient-dense with exciting applications used in a large conventional row-crop farm, we could not resist sharing it. Recently David Yarrow, the author of that article, shared some information regarding Bollinger's farm and costs. He said that by cutting his fertilizer bills by 50%, Bollinger **saved over US\$100 per acre (US\$100,000) on input costs**; we are unable to translate that to Belize dollars because landed costs here would include freight and duty. Bollinger's \$100,000 USD savings on former input costs is worth a further look. For his 2016 corn crop, Bollinger used the same carbon-smart methods, planting with the same 6 inch strips as in 2015, and still with 50% fertilizers (compared to 2014 use). **He harvested 330 bushels (18,480 lbs) per acre in 2016 and had the #1 yield for corn for the state of Missouri.**

In Belize, trials are under discussion between the private sector, government of Belize (GOB) and Caribbean Agricultural Research and Development Institute (CARDI) to undertake efficacy trials using similar methods, planting hybrid corn in Spanish Lookout and open-pollinated at Central Farm.



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The Dairy Industry in Spanish Lookout

An Interview with Frank Friesen and Ernie Thiessen

By Feucht/Roberson



If a Belizean dairy farmer wants to rapidly improve his herd's genetics, he has 3 choices: live dairy cattle importation, artificial insemination, or embryo transfer. The first dairy bull of some merit brought

into Spanish Lookout was a Holstein, flown in from Pennsylvania about 50 years ago, by Joe Friesen, Sr. Many high-producing, locally-born acclimated cows resulted. Belizean dairy farmers have learned that animals born in Belize will out-produce almost any imported blood-lines, and so have moved for the most part to artificial insemination (AI) and now are moving to embryo transfers as a more affordable alternative to importing single animals. Also, percentages have increased to make each resulting animal more affordable.

The Ministry of Agriculture had an AI center at Central Farm from the 1980's, which was located behind the dairy facility and was managed by Orlando Habet. However, due to logistics, there was limited opportunity for private farmers to utilize these services. The first AI school open for local farmers in Belize, teaching AI procedures and awarding AI technician certificates to those successful attendees, was held at Maya Ranch in 1990. John Roberson (Sr.) of Maya Ranch was the first distributor for Tri-State Genetics, the largest bovine semen company in the world at that time, headquartered in Baraboo, Wisconsin, USA. Tri-State's head for international sales, Ron Sersland, traveled to Belize several times to get things going for the AI industry here. The Tri-State instructor for the weeklong course, Joel Groskreutz, began with classroom instruction on bovine reproductive systems and instructions on how to handle the actual semen and liquid nitrogen tanks, before moving on to daily practicals. Maya Ranch had synchronized many heifers and cows, to have sufficient animals in estrus (heat) for this course, allowing daily opportunities in the corrals for actual pregnancy checking and insemination practice. Joel Groskreutz, Belize's first AI course instructor, is now the CEO of Accelerated Genetics – the successor company to Tri-State Genetics. Two of the then younger farmers trained at this first 1990 AI seminar were Frank Friesen and Ernie

Thiessen, both of whom have been leaders of AI in Belize ever since. Frank, who assumed the Tri-State distributorship in Belize from the Robersons after they sold Maya Ranch, received an award recently from Accelerated Genetics for his 25 years of dedicated service. Both Frank and Ernie steadfastly imported new, mainly dairy, genetics into Belize. There has been some reluctance along the way in the community to accept this technology, but overall the improvement made to the quality of the bulls via AI has been a large boost to Spanish Lookout's dairy industry.



7/8 Jersey Cow, 5 yrs, 3rd generation AI, gives 36 lbs milk daily

The introduction to embryo transplants in Belize was slower to arrive in Belize due to the technical difficulties and much higher expense. Ernie states "the value [of an embryo calf] is that being 'born Belizean', even though the embryo was imported, allows the calf to be already acclimatized; that calf born here will always perform better than an imported animal". The late Sir Barry Bowen of Gallon Jug Farm in Orange Walk District was the first to import bovine embryos into Belize; these were purebred Herefords from U.K. Later in 2010 the Ministry of Agriculture organized an importation of embryos of both beef and dairy cattle which were implanted by Dr. Eduardo Flores of Merida, Yucatan. The Ministry implanted 17 embryos; Frank Friesen implanted 8 embryos, resulting in 3 live calves; Roberto Espat implanted 13 embryos, resulting in 3 live calves; and Andre Lopez had 10 red angus embryos resulting in 3 calves.

In 2012, Dr. Eduardo Flores of Mérida, Yucatán, Mexico, returned to Belize and flushed 2 dairy cows, which had been super-ovulated. The results were that one cow yielded 12 embryos for implantation, resulting in 6 live calves; from the other cow 8 embryos were extracted yielding 4 live calves. Some of these embryos were implanted fresh and others frozen. Although not all embryos will withstand freezing, if they are successfully frozen, they can withstand up to 50 years in storage. Several of the embryos which were frozen were implanted by Frank; of 12 implants by him, there were 6 pregnancies and 3 live calves. The cost of the resulting live calves from the imported (Canadian) embryos was Bz\$4,500, and the cost of the live calves from the Belizean embryos was Bz\$1,200 each. Worldwide, a 40% success rate is considered acceptable and a 45% rate is considered good.

Ernie has expressed interest to continue to import embryos; he plans to import perhaps 100 of already sexed embryos in about 2 years, which would hopefully yield 50 live births. These animals would probably cost between \$3,500-\$4,000 at birth. His future

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vision is to flush local high-producing cows, then breed them via AI with imported 'sexed' semen, and then freeze the embryos. Sexed semen cost at least 3 times the price of non-sexed, but then one could predetermine the sex with approximately 95-98% probability.



In 2015 Ernie imported 5 Holstein heifers and 4 Jersey heifers and 9 bulls, all between the ages of 18 – 24 months, from Florida. He accompanied these animals on their travel by ship from Ft. Lauderdale to Belize City.

The number of dairy animals in Spanish Lookout is about the same as it was 10 years ago, but production is always on the rise, overall and per animal. Last year over 6 M pounds of milk were processed at Western Dairies. As the main dairy product made in Belize now is ice cream, there is a concerted effort to move toward breeds producing milk with higher butterfat content, rather than simply high production. Up until now the farmers were concentrating on breeds such as Holstein that produce high yields of high protein milk for cheese. Now Jersey crosses are becoming more popular. There is discussion to adapt the payment systems at Western Dairies to reflect contents of butterfat and protein.

The cow's diet also is an important factor contributing or detracting from the butterfat content of the milk. High fiber leads to higher butterfat; if it is too low, lowered butterfat may result. In Spanish Lookout, about 90% of the dairy herd are grass-fed.

All photos taken at Thiessen Dairy, Spanish Lookout.
Cover photo is Ernie with his NATS champion bull *Potter*.

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BEYOND THE BACKYARD

What on Earth?

By Jenny Wildman

My friend recently hurt his back and was prescribed some pretty heavy-duty unpronounceable medication that was also very expensive. He asked me if I knew of holistic alternatives. I suggested these potent pain killers: bone broth full of glucosamine; turmeric (yellow ginger) as it contains curcumin which is an anti-inflammatory; capsaicin (from chili pepper) which decreases pain signals to the brain and 'tuna' which contains taurine.



"Tuna!! What on earth!"

I was not referring to tuna fish but a cactus Jamaicans call tuna and we in Belize call nopal or prickly pear. It is a member of the Cactaceae family belonging to the genus *Opuntia* with common names including barbary fig, Indian fig, west wood pear, tsabar or sabra, bajtra, tuna cardona, scogineel and pa'kam. The name nopal comes from the Nahuatl language and the word tuna believed to be from the Taino Arawaks who inhabited the

Caribbean and numbered some 2 million in the 15th Century. They were complex peaceable people, organized agriculturists practicing self-sufficiency yet easily annihilated by the Spanish conquerors.

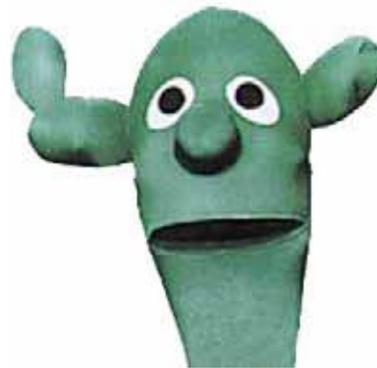
The *Opuntia* was named after the Greek city of Opus where legend said there was an edible plant which could be grown from rooting the leaves, as it does, but its origin is actually in the Americas, principally Mexico where it features strongly in their history. The Mexican coat of arms depicts an eagle perched on a prickly pear with its beak firmly around a serpent. It is claimed that this had been shown as a sign to the people of where to build their capital city. This graphic dominates the center of the green, white and red flag, which, without it, could be mistaken for Italy. The cactus has been displayed in many works of art with sometimes hidden symbolism and truly meaningful to many different people. The coat of arms of Malta (1975- 1988) depicts a prickly pear, a fishing boat and a sun. In 1995 the Texas legislature designated the prickly pear as the official state plant for its ruggedness, beauty and versatility. Across the border the cactus is considered to be the national plant owing to its visibility and importance to the Mexican people. Israel embraced the term *sabra* to describe its Jewish people born in Israel - tough and prickly on the outside and soft and sweet on the inside. One of their first TV shows featured a singing cactus character *Kishkashta* who portrayed their spirit. In 2011, still enamored by the analogy, the Israeli Olympic team chose a cactus figure *Shpitzik* as their mascot but he was unfortunately rejected as a copyright violation as it too closely resembled the TV puppet. The translation of the title of the show from Hebrew is "*What on Earth!*"

Now everything I know about this plant has me repeating that exclamation.

Opuntia ficus-indica and other varieties were cultivated as hosts for the insect *Dactylopius coccus* which is used to make cochineal or carmine dye from the dried insects that have lived by feeding on the cactus sap. The Aztecs and Maya used this to colour fabric and it became a highly lucrative export second only to silver. The 20th Century brought synthetic alternatives and the trade ceased; now due to the discovery that many of these synthesized dyes are carcinogenic, it is once again becoming popular for clothing, cosmetics and food. The colour for many drinks is from cochineal. Attempts at growing elsewhere in the world were not all successful. It failed in Australia where the insects died and the cactus took over the countryside becoming a noxious weed requiring importation of another bug to get rid of the cactus. Today principal

producers are Mexico, Peru and the Canary Islands. The less spiny *Opuntia cochenillifera* is endemic in Mexico and seen everywhere around our country.

Nopal has been used traditionally as a medicinal plant said to: fight cancer, protect brain cells, lower cholesterol, lower blood sugar levels, help the pancreas to develop insulin, fight viruses and reduce hangovers. It is high in dietary fiber, contains thiamine, niacin, riboflavin, B6, calcium, iron, magnesium to builds strong bones. It is good for weight loss, constipation, prostate problems, stomach aches, psoriasis, headache, insect stings, eye infections and reduces serotonin which increases melatonin, aiding sleep.



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The cladodes, leaves or paddles can be split in half length-wise and applied to cuts to reduce bleeding, soothe burns, sunburn, chest congestion or to the head for one hour to relieve a headache. The sap of the cactus is used as shampoo, conditioner, to control dandruff and is an effective insect repellent.

Tuna for back pain: 1/2 paddle steeped in 2 cups of boiling water for 20 minutes. Strain and add 2 teaspoons of honey as it is a little bitter and drink or steep 3 paddles overnight in 4 cups of water, refrigerate and take 2 tablespoons each morning. Make fresh each week.

We cannot expect that any varieties used in any studies are the same today and some species may have more active ingredients than others. However with the extent of its capabilities it could be considered a super food.

The fruits called tuna or figs are grown commercially and can be purple, red, orange or green depending on variety. The red is perhaps sweeter like watermelon and the green is preferred in Mexico. It can be eaten raw, made into jam, jelly, tea, colonche - an alcoholic drink in Mexico and bajtra which is a liqueur in Malta. Once picked the fruit has limited shelf life so juice and enjoy: mix with orange juice or fresh coconut water. The plant flowers in spring and early summer each turning into the fig or tuna fruit along the outside of the paddles. All prickly pears are edible but better to choose to grow the spineless variety and pick the young green pads for culinary use. The pads can be cooked all ways but are a bit slimy like okra. Pick the pads, chop off each end where it is tough and if older, peel the outer edge. Fry up with onions and tomatoes then add beaten eggs for delicious breakfast. Add to smoothies, eggs or tacos. When introducing any new food, do so gradually.

The plant is fairly fast growing and prefers semi-arid conditions. The paddles are the actual stems of the plant and grow at odd angles up to a height of seven feet. Depending on species they can have sharp spines protruding from pads and then tiny spines or glochids can be found at the base and must be avoided as they cause irritation. When you plant cactus you are enhancing the soil's structural stability and quality. It makes an inexpensive hedge that can control erosion. Such a boundary is good for controlling cattle and also offers free fodder with valuable moisture and apparently adds a uniquely sweet flavor to the milk.

During the 16th-18th centuries the sap of the nopal was used in churches and convents for painting walls and murals. Techniques created by artists were tempera and fresco using coloured minerals binded by the secretions from prickly pear and other plants. This sap has also been used to waterproof roofs of adobe houses.

The vibrant flowers in bloom are a wondrous sight and the dancing puppet made me laugh but the cactus is more than just a pretty face. The Opuntia has a multitude of uses worldwide, with a very interesting and colourful past.

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A Case for Changing Agriculture in Belize

By Dr. Johnathan Canton

In the early 1970's, the late Earl L. Butz, 18th US Secretary of Agriculture, famously said, " Before we go back to organic agriculture in this country, somebody must decide which 50 million Americans we are going to let starve or go hungry." This came at a time when the American biologist and Nobel Peace Prize winner Norman Borlaug was pioneering the Green Revolution at the Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT) in Mexico. The Green Revolution brought about significant increases in the yield of a select few agricultural crops through the adoption of various new technologies including, but not limited to, high yielding grain varieties, advanced irrigation systems and the extensive usage of synthetic pesticides, herbicides and fertilizers. Ironically, this relatively new form of farming became known as "conventional" and traditional methods of farming were placed under the blanket term "organic" and, in many circles, became a testy topic of conversation. Organic agriculture became an ideology, one that had to give way to the banner of scientific innovation. In a flare of reductionism, the ultimate goal of conventional agriculture became higher yields per unit area. One single metric, yield, was driving the large majority of research and investment. Now, however, over 50 years since the dawn of the Green Revolution, the science of agriculture is changing. Additional metrics have begun to be considered in studies comparing organic and conventional methods and new information calls into question the long-term sustainability and safety of conventional farming technologies. Meanwhile, the growth of the acreage under organic cultivation is increasing dramatically, sales have increased four-fold in the last decade in Europe (Rabes et al., 2014), and worldwide sales are expected to double in the period between 2013 and 2018 (Lernoud and Willer, 2016). As the world embraces, or perhaps more aptly re-embraces organic agriculture, where do we stand in Belize and more importantly where are we going?

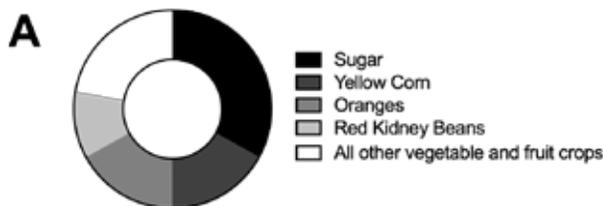
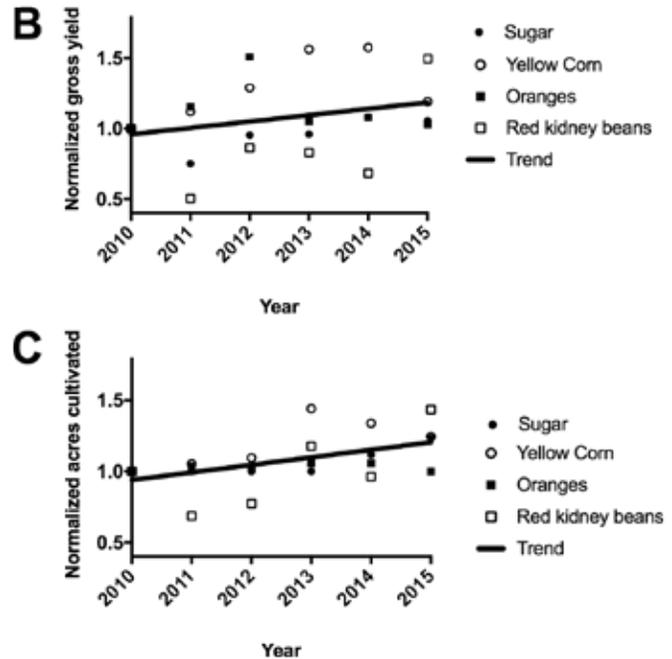


Figure A. Metrics for four major crops in Belize from 2010 to 2015. A. The donut plot shows the acres cultivated for four major crops in Belize as a fraction of the total acres cultivated in the country. B. The gross yield for four major crops in Belize from 2010 to 2015. Values are normalized to gross yield in 2010 for each respective crop. C. The acres cultivated for four major crops in Belize from 2010 to 2015. Values are normalized to acres cultivated in 2010 for each respective crop. All raw data was obtained from the Belize Ministry of Agriculture.

The methods of the Green Revolution have found a comfortable home in Belize. In 2015, more than fifty percent of the acreage under cultivation in Belize was attributed to only four agricultural crops: sugar, yellow corn, oranges, and red kidney beans (see Figure A). This intensification of single crop species over massive

acres has streamlined the application, often mechanized, of large quantities of fertilizers, herbicides and pesticides. Indeed,



the importation of synthetic agricultural inputs has increased significantly over time in Belize and in 2016 we imported a net mass of over 100 million pounds of fertilizer and pesticide products (data from Statistical Institute of Belize). We have also seen a tendency toward increases in gross crop yields over time (Figure B) as the management of larger acreages has become more feasible (Figure C). Belize is clearly charging down the path of conventional intensification. Rarely, though, do we stop to question the impact and more importantly the sustainability of this path.

If we are to consider the necessity of conventional agriculture in Belize, we must first tackle the issue of productivity. The yield gap between conventional and traditional farming systems is often assumed by critics of organic farming to be clear-cut, undeniable evidence against its practicality. The yield gap can be understood as the difference in yield per unit area of a given crop when it is simultaneously grown using different management protocols. This comparison has been made for various crop species grown under either conventional or organic management practices. On average, organic farming practices result in yields that are 20-25 percent lower than conventional systems (Kniss et al., 2016; Seufert et al., 2012). This single metric is tacitly assumed to be an unacceptable detriment to the farmer's bottom line. In Belize, however, the situation is slightly different. Unlike many of the countries in which the above-mentioned studies were performed, conventional agricultural inputs in Belize are mostly imported products. In fact, in 2016 we imported agricultural inputs including fertilizers, pesticides, fungicides and herbicides from 31 different countries at an approximate cost of 60 million Belize dollars (data from Statistical Institute of Belize). On top of that, recent studies have shown that energy inputs (including fertilizer and fuel) for conventional farming can be as much as 50 percent higher than for organic farming practices (Bilalis et al., 2013; Mäder et al., 2002) and the energy cost of pesticide application on organic farms

is reduced by 97 percent (Mäder et al., 2002). With the rapidly increasing cost of fuel and other imported agricultural inputs, the Belizean farmer's profit can only decrease as dependence on these components of conventional agriculture increases. Strict organic management strives for the large majority of inputs to be farm-derived and this feature dramatically reduces both the freight and gross input cost, with the caveat of extra farm labor required for the generation of inputs (Crowder and Reganold, 2015).

A final and salient point is the data emerging from several long-term studies comparing yields from conventional and organic farms over time. Various indicators of soil health including organic matter content, overall biomass and biodiversity are reduced over time in conventional farming systems (Fließbach et al., 2007; Forster et al., 2013; Mäder et al., 2002). Organic management, on the other hand, has been shown to have the opposite effect in both temperate and, relevant to Belize, tropical regions of the world (Fließbach et al., 2007; Forster et al., 2013; Reganold and Wachter, 2016; Seufert and Ramankutty, 2017). In some instances, the concurrent decrease of conventional yields and increase of organic yields over time effectively narrows the yield gap rendering it inconsequential in the long term (Forster et al., 2013). The significance of the yield gap then, from the perspective of the Belizean farmer, is complicated by the ever-rising cost of imported fuels and agricultural inputs as well as dwindling soil health.

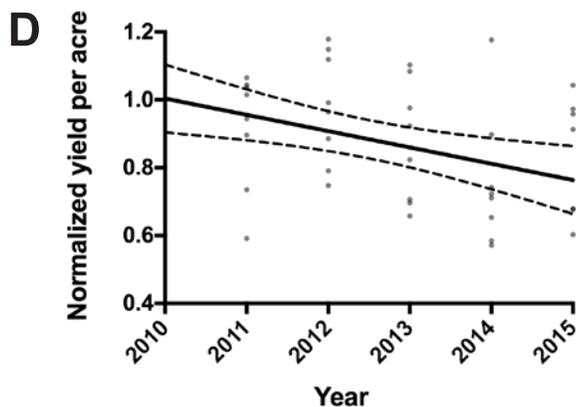


Figure D. Decreasing yields per acre of Belizean grain and bean crops from 2010 to 2015. Yields per acre for red kidney beans, black beans, cowpeas, soybeans, yellow corn, white corn, rice and sorghum from 2010 to 2015 were plotted as grey dots. Data was normalized to yield per acre values for the year 2010. A trend line for the aggregated data was plotted using Graphpad Prism 7.0 and is shown as a solid black line. Dotted lines indicate 95 percent confidence intervals. The raw data was obtained from the Belize Ministry of Agriculture.

Yield is increasingly recognized as only one measure that factors into the long-term sustainability of farm management practices. In particular, three other sustainability metrics have been defined by the United States National Academy of Sciences as being equally as important as yield and they include the social wellbeing of the farmer, the economic viability of the farming practice and the environmental impact of the farming procedures (Council, 2010; Reganold and Wachter, 2016). In two recent meta-analyses (a powerful technique which uses rigorous statistics to compare data from a large body of independent studies) published in the science

journals Nature Plants and Science Advances, these criteria were used to compare the effect of both conventional and organic farming techniques on each of the four sustainability metrics (Reganold and Wachter, 2016; Seufert and Ramankutty, 2017). Apart from the expected result of lower yields, organic farming out-performed conventional farming on all the sustainability metrics. This is part of a larger scientific understanding that has been slowly unfolding but is now beginning to garner mainstream acceptance in the peer-reviewed academic literature. From an environmental perspective, long-term studies are beginning to show enhanced biomass, increased species richness and higher organic matter content in organically managed soils (Gattinger et al., 2012; Leifeld and Fuhrer, 2010; Mäder et al., 2002; Tuck et al., 2014). Of relevance to Belize, these factors have been shown to buffer against the effects of adverse weather extremes such as hurricanes and drought. In the past five years, the downward trend in grain and bean crop yields per unit area in Belize (Figure D) has been attributed to an unusually high incidence of adverse weather events. It is worth noting that organic crops have been shown to be significantly more resilient to such events, including hurricanes, showing less topsoil erosion, lower vegetation loss and lower economic losses than conventional crops (Holt-Giménez, 2002).

Organic farming systems were also shown to have more direct benefits to the farmer's wellbeing in terms of health and economic profitability. For example, other long-term analyses are now showing that the significant reduction of pesticide applications

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BEL-CAR Updates



Photo by Rosando Thiessen

Black-Eyes

As we go to press, the bean harvest in Spanish Lookout, Cayo District is in progress. Bel-Car states that there is less acreage in black-eyes for this season, possibly up to 50% less, for several reasons. Last year's crop was very large, but rains at harvest time reduced the quality. Nevertheless 25 containers (50,000 lbs. per container) of last year's grade 'C' black-eyes were exported in December 2016 and January 2017 to a new buyer in Egypt. Bel-Car manager Paul Penner explained to Belize Ag Report that the documentation for this shipment was a bit cumbersome, involving paperwork required from the Egyptian Embassy in Mexico City. Timing of the paperwork is crucial; these completed papers need to arrive at the destination before permission is given to unload the freight items.

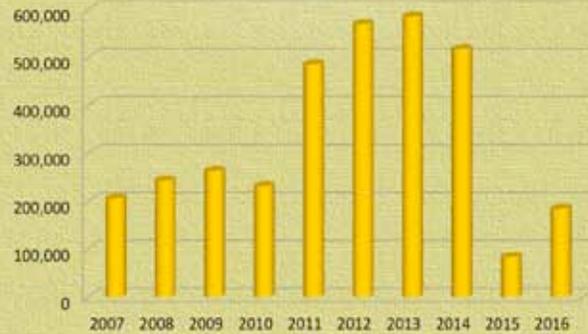
Corn

Roughly 12,000 (100 lb) bags of corn were harvested by Bel-Car farmers. 'A' grade corn price for Spanish Lookout has been listed as N/A - not available - on our centerfold *Prices at a Glance* page, for quite some time, as it is not sold in bulk, but rather used in the production of high quality corn meal. This cornmeal is sold both domestically and exported within our CARICOM market, particularly to Jamaica. Cracked corn is also exported, mainly to Trinidad, where it is used primarily by the back yard (small scale) poultry farmers. Yellow corn, grade 'C' is available currently in bulk for export. The principal market at this time for grade 'C' is Guatemala where it is used primarily in poultry feeds.

Approximately 90 % of the corn grown by Bel-Car co-op members is yellow corn; the remaining 10% is white corn which is exported primarily to Guatemala where it is used for tortillas.

The chart below, prepared by Bel-Car, shows their yellow corn trends for the past 10 years. The ramifications of weather events to production are clearly shown: 2015 (severe drought) and 2016 (hurricane).

Bel-Car Yellow Corn Sales



Corn prices (not reflected in the chart) were good for the years 2011 thru 2014. Then prices, affected by a declining world corn market price, as well as yield reductions due to the weather events here, have created a challenging situation for our farmers. World corn production is expected to rise globally in 2017, which may subdue the rise in corn prices farmers might wish to see. However, we are hopeful for an increase in both yield and prices for the upcoming corn season.

BAR thanks Mr. Paul Penner and Mr. RosandoThiessen of Bel-Car for their time sharing the Bel-Car news.



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PLANT LOCATION:

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has little to no effect on crop productivity and profitability (Lechenet et al., 2017) and that profitability on organic farms even increases significantly over time as indicators of healthy soil increase (Liu et al., 2016). This comes with the added benefit of reduced exposure of farm workers to harmful agricultural inputs. Pesticide poisoning is a very real and hazardous reality for farm workers, particularly in developing countries like Belize, where government resources for pesticide management are limited (Eddleston et al., 2002; Thundiyl et al., 2008). To put this into perspective, it has been estimated that the developing world uses 20 percent of the world's agrochemicals, yet 99 percent of the worldwide deaths associated with them occurs in developing countries (Kesavachandran et al., 2009). In Belize, accidental exposure often seems to be a consequence of the apparent impracticality and expense of donning the appropriate protective equipment, and the misconception that a lack of symptoms from acute exposure is evidence of non-toxicity. Yet chronic exposure is just as likely to cause adverse health effects (Kim et al., 2017). Organic certification programs like the International Federation of Organic Agriculture Movements (IFOAM) have also reinforced the social wellbeing of organic farmers by making social wellbeing goals an integral part of the certification process. As a result, it has been demonstrated that organic farmers experience more socio-cultural benefits, including stronger relationships with consumers, upward trajectories in the economic growth of their community, and more steady employment rates (Grùère et al., 2009; MacRae et al., 2007; Mendoza, 2004).

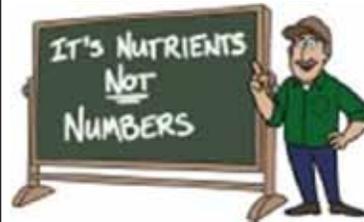
So there is a case. Whittled down to its barest of forms. After all, we haven't spoken of the effect of agrochemical leaching on our riverine and marine ecosystems, the level of control of pesticide residues on the food that reaches the consumer, or even the potential economic gains that might be had from tapping into the rapidly expanding organic markets in the developed world. A case has been presented for the social wellbeing of our people, for the surety that generations to come will enjoy our unique, fragile ecosystems. Perhaps it is time to reevaluate what our current understanding of productive agriculture is, as is being done in research institutions the world over. Real, peer-reviewed research should inform government policy on this issue. So, to pose the question once more: Where are we going?

A comprehensive list of reference material used for this article is on our website, on the PDF replica of the printed version, pgs 41-42.

Editor's Note: Johnathan's points and especially those regarding the costs of imported inputs are noteworthy. Damage reports following the 2016 hurricane mentioned several main agriculture sectors (citrus, bananas) worried about adequate foreign capital for imported input purchases. Might we reverse this trend of what might be called a type of new agricultural colonialism-purchasing costly foreign inputs in order to grow and export raw materials? One hears from the Minister of Agriculture and others, "Belize can never compete on quantity – we must compete on quality." World trends are leaning towards higher revenues from non-GMO grains and products clear of pesticide residues. Let's be ready.



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National Coconut Stakeholders Platform Meets in Blue Creek, Orange Walk District



Photo by Robbin Burns

On Friday 31 March, the NCSP had its bimonthly meeting at the coconut farm of Sergio and Tina Marraquin. Almost all of the 12 original committee members plus many visitors

who were all interested in learning more about the potentials of coconut farming in Belize made the trek to the remote Mennonite village in the northwest corner of Belize. Mr. Manuel Trujillo, Crops Coordinator of Central Farm called the meeting to order, and Ms. Omaira Avila, our (relatively) new Caribbean Agricultural Research and Development Institute (CARDI) country representative took the reins of the meeting. As CARDI is officially appointed as the 'focal point', contracted to manage and fulfill the agronomical part of this Bz\$5 M project, Ms. Avila reminded the group throughout the morning of the various tasks needing to be accomplished before the ending of this project in January of 2019.

There were 3 'cluster group' meetings held in January: one in the north, one in the south, and another in Cayo District. Every area group requested training. The original roadmap plan for Belize has training for 'good agronomic practices' on it. The project will send two persons to St. Lucia to learn more about managing cluster groups. It is envisioned that these groups will eventually morph into a national association of coconut farmers and processors.

Integrated pest management (IPM), where farmers use different management tools, rather than just chemicals, was discussed and the committee eventually agreed to put energies toward addressing 3 challenges to the industry: 1. Red ring disease – focusing more on control of the vector weevil rather than the bacteria; 2. The red palm mite, and 3. Empty nut/nut drop. The latter, occurring in various parts of the country, could be either a management problem or disease. It is necessary to determine the source of the problem in order to stop it.

Ms. Margaret Ventura of the Foreign Trade Directorate suggested and the attendees agreed, that public service ads running on TV and in various media are immediately needed to inform the public and ask for their cooperation.

During a vigorous discussion about varieties, several in the private sector expressed frustration that Belize does not currently have local research results available to assist in selection of varieties: knowing which would do best in which part of Belize, which would be the most disease resistant to our specific problems, etc. As coconut trees bear for decades, some compare planting them to 'getting married to them'; one must select well because it is for long term. Ms. Avila announced that under this wide Caribbean project, some of the countries will do experimentation plots and some will do research; Belize will do research. The need for more nurseries was also identified again as critical. Larger growers have tended to import from Mexico, varieties such as Chactemal, at a landed cost of about \$16 per starter. Smaller farmers have tended to use locally available varieties such as maypen, dwarf, etc. due to the much more reasonable cost. Discussion followed

on whether it would be advisable to establish certified nurseries such as citrus has, and what policies GOB should implement.

Regarding marketing, Ms Avila questioned, “Who are the processors? Who will purchase the rapidly expanding acreage of coconuts here?” Efrain Rejon, agronomist with the Marroquin farm, noted that we could easily flood the market; the export markets need to be established. Tex-Bel Farms have already begun exportation, and Ms. Avila underlined that “As a nation, for all, large and small, we need to create a group to identify target markets, how to get them and their requirements”. All agreed that national standards for quality of coconut products need to be developed.

Teams that were set up to deal with specific issues and meet before the next NCSP meeting are: 1.Communications/Awareness/Publicity, 2. Quality and Standards, 3.Training, 4.IPM, and 5. By-products.

Ms. Robbin Burns of Development Finance Corporation (DFC) made a presentation describing their interest in assisting with financing of coconut farms of all sizes. Following lunch the committee had an extensive tour of the Marraquin farm. The next NCSP meeting is scheduled for 17 May at a venue yet unspecified.

National Agriculture and Trade Show



The 47th annual National Agriculture and Trade Show (NATS) was opened on Friday 28th April under the theme “Let’s Get Growing”. The opening ceremony was highlighted



by keynote addresses by University of Belize’s new president Dr. Clement Sankar; and Minister of Agriculture, the Honourable Godwin Hulse; and by the presentation of the Farmers of the Year awards. Male Farmer of the Year went to Mr. Gary Canto of Cayo District; Female Farmer of the Year was Ms. Mirva Flowers of Toledo District, and Junior Farmer of the Year was awarded to Mr. Santiago Gutierrez of Cayo District. NATS chairman Mr. Gary Ramirez estimated that close to 40,000 people visited the 3 day fair, which concluded on Sunday 30th April, at the newly renovated show grounds in Belmopan.

Agricultural Production Statistics Blue Creek

	2016	2015	2014
YELLOW CORN:			
Production (lbs)	18,281,965	6,714,701	4,941,405
Acre harvested	4,316	1,115	1,390
Average Yield (lbs)	4,236	6,022	3,555
RICE (Paddy):			
Production (lbs)	19,636,760	16,230,880	16,323,615
Acres Harvested	4,110	4,120	3,550
Average Yield (lbs)	4,778	3,940	4,598
SORGHUM:			
Production (lbs)	2,270,380	851,530	513,765
Acres Harvested	725		
Average Yield (lbs)	3,132		
SOYBEANS:			
Production (lbs)	5,619,230		
Acres Harvested	2,724		
Average Yield (lbs)	2,063		
BLACK-EYED PEAS:			
Production (lbs)		1,211,758	681,345
COCONUT:			
Acres	440		
LIME/LEMON:			
Yield	35		
CATTLE:			
Beef Population (Head)	17,443		
Head Slaughtered	692		
Head Exported	3,928		
POULTRY:			
Chicken Live Weight (lbs)		9,014,697	
Turkey Live Weight (lbs)		49,204	
Eggs (dz)		894,480	



Photos by Sally Thackery

Integrated Pest and Disease Management (IPDM) in the Sugar Industry

SIRDI EU IPDM

Sugarcane Farmers Seminar

By Jeffy Gomez, SIRDI EU IPDM Project Manager



On April 12, 2017 the Sugar Industry Research and Development Institute (SIRDI),

the Government of Belize (GOB) and the European Union (EU) held a first-of-its-kind Integrated Pest and Disease Management Seminar at SIRDI's headquarters in Buena Vista Village, Corozal District. A total of 185 stakeholders, including sugarcane farmers, sugarcane farmers associations, community leaders, students and NGOs, attended. Many farmers and stakeholders from the northern sugar belt are now well-versed and prepared to tackle



the main pest in the sugarcane field known as the froghopper.

Starting at 9:00 A.M. with a brief welcome from SIRDI's executive director, Mr. Marcos Osorio, Mr. Jeffy Gomez then gave an overview of the project

"Strengthening of IPDM in the Sugar Industry", Mr. Luciano Chi, SIRDI EU IPDM Project Head of Unit, gave an explanation of the importance and strategies of an IPDM program in sugarcane production, and SIRDI's extension officers Mr. Saul Vasquez, Mr. Miguel Keme, Mr. Daniel Villanueva and Mr. Jose Campos presented on the importance of biological control of froghopper, egg sampling, field monitoring, mechanical and ethological control. Mr. Vasni Pech, SIRDI's GIS Technician also presented on the importance of field data and maps that can be obtained from the Sugar Industry Management Information System (SIMIS).



The day's session proceeded with field demonstrations which were especially useful to the stakeholders. All farmers and stakeholders were

divided into 4 groups: 1. egg sampling for froghopper egg count, 2. sanitary harrow which could encompass trash lining, light harrow or phytosanitary harrow 3. monitoring traps and 4. biological and chemical control.

1. Soil sampling for froghopper eggs count

This activity, an important tool in the implementation of IPDM, is a procedure for determining the quantity of froghopper eggs present in the field, thus its potential population, to prepare for any outbreak before it happens. It encompasses two parts: a. collection of samples in the field and b. laboratory analysis.

SIRDI...Continued on page 23



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AgScience for Better Crops

Plant Disease Management

By: Felix C. Cawich



Agriculture in Belize has experienced a rapid expansion and diversification of crop production. Such changes come with increased challenges that growers have no control over and must learn to adopt and implement effective management practices. Currently the increase of pest and diseases remain a major threat to crop production. Moreover, there are main factors contributing to plant disease management, which include 1) the demand for safe and diverse food to support the growing population, 2) reduced agriculture production, 3) ecology of agro-ecosystem deterioration and natural resource depletion, and 4) increased disease epidemics from agricultural intensification and monocultures (He et al, 2016)

Economic losses in agriculture are primarily due to plant diseases, which are responsible for 20 – 40% loss of the global agriculture production (Savary et al, 2012). Plant disease management is so variable that it is full of myths and false truths mentioned because of ignorance, dishonest commercial interest, failure to ask and incompetent technical assistance. In the following paragraphs, information provided will clarify doubts on this topic (Quintero, 2017).

1) **Diseases do not just pop up!** Plants may present disease symptoms when three of the following factors are met: a) a susceptible host; b) pathogen; and c) favorable environmental conditions for the pathogen and unfavorable for the host. This can be explained by the disease triangle shown in Fig. 1.

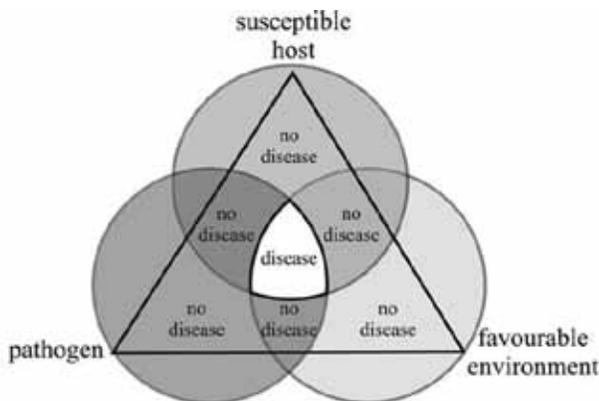


Fig. 1: Disease triangle (Source: Moore, 2016)

2) **There are no super pathogens!** Only plant pathogens exist. Whenever a disease gets out of control, either they were always there or were preceded by inadequate agronomic practices that favored these organisms to become out of control. Therefore, when there is a disease outbreak, always think what you have done (or not done) that favors the pathogen. Remember, all pathogens go through the same disease cycle (Fig. 2) and knowing how particular pathogens go through it, is important in developing management strategies (Paret et al, 2015), that will interrupt this cycle.

3) **Magical potions do not exist!**

The success in agriculture, without doubt, is the result of many things done in the right manner. When this occurs, there is minimum need for chemicals or magical formulas to obtain excellent yields and quality of the crop. But if things get bad from the beginning, chances



Fig. 2: Disease Cycle (Source: Arneson, 2001)

are that during the crop cycle a set of badly taken actions at the wrong time accumulate, resulting in poor results. In certain cases, this makes us want a product or magical formula to “undo” the wrong actions or “correct” the final result; this NEVER happens.

- 4) **A nutritionally balanced plant supports an attack from pathogens.** A healthy plant suffers less yield/quality loss than a plant with unbalanced nutrition. The most common nutrient disorders are: a) excess of nitrogen; b) deficiency of potassium, calcium or magnesium; c) lack of micronutrients like zinc, boron, manganese, iron, copper, molybdenum.
- 5) **Successful management actions are taken when the pathogen is in its first stages of development.** Early detection (crop monitoring) allows the observation of initial lesions; the control taken at this point generally derives to a proper management of diseases.
- 6) **Monocropping has devastating effects on plant health.** Crops grown in various cycles on the same acreage, will have major phytosanitary problems, year after year. Occasionally, damages are greater each time, unless adequate measures are implemented.

Given the incidence of diseases in agriculture, and the increased losses caused, the concept of *integrated disease management* (IDM) is being implemented by many farmers; IDM is based on the five basic principles of plant disease management (Razdan & Sabitha, 2009):

- 1) **Avoidance:** avoiding diseases by planting when pathogen is absent, inactive, inoculum levels low, or environmental conditions are not favorable.
- 2) **Exclusion:** using pathogen or disease-free seeds, thus preventing the inoculum from entering or establishing in the field.
- 3) **Eradication:** reducing or destroying inoculum at the source with chemicals, heat, etc; rotating crops that cannot sustain the pathogen.
- 4) **Protection:** preventing infection by using chemical spraying, seed treatment, protectant fungicides, etc.
- 5) **Resistance:** using resistant varieties thus preventing infection.

Important practices in managing diseases in agricultural crops rely on knowledge of crop disease, field scouting, record keeping and identification of pathogens. Disease management improves by breaking the disease cycle through crop rotation, fungicide application and weed control; manipulation of host factors

Plant Disease... Continued on pg 19

Neal Kinsey Soil Fertility Course

In the last days of February, Neal Kinsey arrived at University of Belize's College of Agriculture at Central Farm to present his Intro 2 course on soil fertility using the Kinsey-Albrecht system. This was Neal's 3rd teaching trip to Belize, and many of the participants had already attended one or both of his previous courses here. One of those repeating farmers said to Neal at the conclusion of the final class day, "Neal, you are changing the face of agriculture in Spanish Lookout". What higher accolade can be given to our friend Neal? Other student comments on the annual surveys which asked, "What did you gain from this course?" included:



"a better understanding of the complex interaction among elements and soil types and water", Dottie Feucht

"... improved understanding of soil health to improve production by feeding the soil and allowing soil to feed plants", Edwin Gomez

"a clear view of how the macro and micro-elements are used by the plants and the benefits of elements; I have seen that we need to invest in agricultural products which will increase our yields", Isai Sosa

"the major importance and roles of the micronutrients and macronutrient elements required for soil correction in order to increase yields"

"the efficient use of fertilizer, so as to benefit the plant, the environment and the soil; soil science is the base of agriculture", Denzel Castillo



"the difference that correct levels of micro-nutrients

can make; til now I always put too much emphasis on pH levels, not considering where the Ca or Mg levels are", Tyron Dueck

"mostly micronutrients but also N, P, K, S; learned that some fertilizers are better than others; was a great course; definitely coming back for the next one again!!", Marlon Dueck

"how to interpret micronutrient levels and how to mend problems; we need to know the why!"

"the importance of soil analysis with regards to determining fertilization programs", Cornelio Tzib

"After 15 years of farming rice, I found out that I was using the wrong zinc", Otto Dueck

"We need to be cautious to use the right sources and amounts of fertilizer"

Research online shows that other venues of this course often charge double or triple the course fee here. Here they are not presented on a profit basis. Take advantage of Neal's 4th trip, scheduled for September 3rd, 4th, & 5th of September 2018. For registration information contact David Thiessen at Agro-Base (ad on pg 13).



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"Thanks very much for last year's [recommendations]. It was the best corn crop in this area ever. We think we averaged over 200 bu per acre. The highest check we happened to take was 265 bu per acre which was the second highest that our Pioneer dealer took. Most beans were in the lower 50's in this area but ours averaged 60."

Randy Vogeler, Garrison, Iowa

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Abrasive Weeding Weed Control Using a Grit-Blaster



Weed scientist and USDA agronomist, Frank Forcella of Minnesota, U.S. solved two problems with one invention that he calls “PAGMan”. The first problem was how to get rid of the pits from his bumper crop of apricots; the second was how to get rid of weeds in row crops. He says that combining those two into a single solution seemed silly at first but he and colleague, Dean Peterson, at the USDA North Central Soil Conservation Research Laboratory in Morris, Minnesota, bought a cheap sand blaster and started some simple experiments in a greenhouse. Their initial work involved growing weeds next to a corn plant; when the corn was about six inches tall and the weed was about one to three inches tall, the researchers blasted both with a split-second application of grit.

It turned out that the weeds disappeared while the corn plant was fine. This prompted a field experiment in 2012 with a bigger sand blaster mounted on an ATV. While Peterson drove, Forcella followed, crouched over with the sand blaster nozzle blasting weeds, a back-breaking job for the blaster person. Next step: they contacted Dan Humburg, a professor of agricultural engineering at South Dakota State University, who had the skills to build a specialized machine.

The main component of the machine, known as PAGMan, is an air compressor that sends pressurized air to nozzles aimed at the bases of crops. Farm residues, fed into the nozzles, are drawn through the fast-moving air. Most gritty leftovers, such as seed meals, nut shells, fruit pits, and corn cob grits, work. (A current favorite of Forcella’s is granulated poultry manure: “We can weed and feed at the same time,” he says.) PAGMan has four pairs of nozzles and shreds weeds up to two inches high, but it leaves corn plants four inches or taller intact. Two applications, at corn’s three- and five-leaf stages, provide about 80 percent season-long weed control, Forcella says.

A second model, the Veggie Blaster, is overseen by Sam Wortman, an assistant professor at the University of Nebraska. The machine specializes in vegetables, which have much wider row-spacing. Pulled by a small tractor driven between two rows of vegetables, it kills weeds in a single row. Typically in the U.S., vegetables, such as tomatoes, are grown in trellised rows covered by plastic. As weeds poke through the holes punched in the plastic to transplant seedlings, they are spot-sprayed with grit.

Interest in the method, known as “abrasive weeding,” keeps growing. A two-year field study at the University of Illinois

Sustainable Student Farm found the technique may reduce the need for tillage and hand-weeding; and in Spain, a group of collaborators at the University of Seville are developing their version of a veggie blaster, which can sense a weed and turn on only when needed.

There are purposely no patents on any of the equipment; Mr. Forcella said his team wants to float the concept and test the idea and allow the public to build their own. The main cost of the machine is the compressor; the PAGMan’s was \$9,000. On the other hand, home-made units for small operations would likely cost no more than \$1,000. In fact, given Forcella’s descriptions, Amigo Bob Canistano, a California organic grower and crop advisor, built a veggie blaster for less than \$250. It took about three hours. He bought a sandblaster unit, walnut shell meal, fittings and hose; made a “wand” out of PVC and brass fittings; then attached it to his portable electric air compressor. The device requires a source of electricity, but by mounting it on a cart along with his gas Honda generator, he can now pull it around to a field or trees by hand, tractor or riding lawn mower.

Plant Disease... Continued from pg 17

through different crops and varieties; and modification of microenvironment within the crop canopy using tillage practices and stand density. In addition, practices such as seed treatment, date and seeding rate, balanced fertility, among others, can be utilized (Krupinsky et al, 2001), as shown in Fig 3.

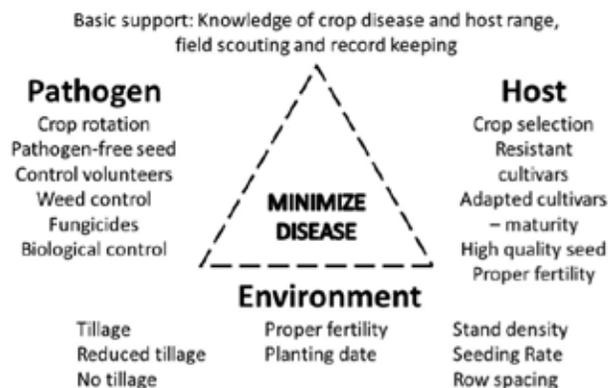


Fig 3. Integrated Disease Management
(Source: Krupinsky et al, 2002)

Note: bibliography of this article can be obtained upon request at info@danausconsultants.com.



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Agriculture Prices at a Glance- \$\$\$\$\$\$

MAY 2017

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. Prices intend on being farm gate in Belize dollars - usually price per lb

BELIZE CATTLE by District - Provided by BLPA						
	T	Dist.	Per lb	Dist.	Per lb	Per lb
Fattened steers	H/L	Czl	1.65	OW	1.95	Bze 1.50
750-1100 lbs	S/H	Cy	1.65	SCr	N/A	Toi 1.50-1.75
Weaner steers	S/H	Czl	1.95	OW	2.00	Bze N/A
"	S/L	Cy	1.90	SCr	N/A	Toi 1.50
Breeding heifers	L	Czl	1.55	OW	1.65	Bze 1.55
"	L/S	Cy	1.45	SCr	N/A	Toi 1.50
Cull cows	L	Czl	1.35	OW	1.25	Bze 1.05
"	H	Cy	1.30	SCr	N/A	Toi 1.00
U.S. CATTLE						
U.S. price - corn fed - 1000-1200 lbs	H	US\$ 1.24625				
U.S. price - feeders 600-800 lbs	H	US\$ 1.49750				
BELIZE HOGS						
Weaner pigs - 25-30 lbs - by the head	S	100.00				80.00
Butcher pigs 160 - 230 lbs, per lb	S	1.85				1.65
BELIZE SHEEP						
Butcher lambs - live per lb	S	2.75				2.50
Mature ewes - live per lb	S	2.00				1.75
BELIZE CHICKEN						
Wholesale dressed, per lb (Sp Lkt)	S	2.32				
Wholesale dressed, per lb (BI Crk)	S	2.40				
Broilers - live per lb (Sp Lkt)	L	1.14				
Broilers - live per lb (BI Crk)	L	1.21				
Spent hens - per lb (Sp Lkt)	L	.78				
Spent hens per 4 lb bird (BI Crk)	S	3.00				
CITRUS						
Oranges per lb solid, est. final	S	2.5929				
Grapefruit per lb solid, est. final	S	2.5498				
COCONUTS						
Green Coconuts, del'd to Cayo, bulk	S	sm	.40	med	.45	lg .50
Dry Coconuts, del'd to Cayo, bulk	S	.35 - .40				

GRAINS, BEANS & RICE						
	T	A	B	C		
Belize yellow corn, bulk (Spanish Lookout)	L	N/A	N/A	.23		
Belize yellow corn, bulk (Blue Creek)	L	.27	N/A	N/A		
Yellow corn/local retail (low volume, Sp Lkt)	S	.285				
Belize white corn, bulk (Spanish Lookout)		N/A	N/A	.26		
Belize white corn, (Cayo)	S	.45 (low volume)				
US Corn, #2 yellow	L	US\$4.0525 /56 lb bushel				
US organic, #2 yellow corn feed grade	S	US\$8.00-8.25 /56 lb bushel				
Belize soy beans (Spanish Lookout)	S/L	.50 contract	.48 non-contract			
Belize soy beans (Blue Creek)	S	.52	N/A			
US soy beans, #2 yellow	L	US\$9.85 /60 lb bushel				
US organic, #1 feed grade soy	S	US\$17.50-18.00 /60 lb bushel				
Belize milo (Spanish Lookout)	L	.19				
Belize milo (Blue Creek)	L	.21				
Red kidney beans (Spanish Lookout)	H	.95	.75	N/A		
Red kidney beans (Blue Creek)	S	N/A				
Black eyed peas (Spanish Lookout)	H	.75		.65		
Black eyed peas (Blue Creek)	H	.82		undetermined		
Paddy rice per pound (Spanish Lookout)	S	.40-.53 farm price, dried				
Paddy rice per pound (Blue Creek)	S	.40-.50 farm price, dried				
HONEY						
Honey, 5 gal (approx 60 lbs)	H	\$210.00 (CQHPC)				
Honey, specialty, 5 gal (approx 60 lbs)	H	\$210.00-250.00 (Cayo)				
SPECIAL FARM ITEMS						
Eggs - tray of 30, farm price	S/L	4.83 (Sp Lkt)	5.10 (Blue Creek)			
WD milk per lb to farmer	S	contract & non-contract .56				
Raw milk (farmer direct sales)	S	5.00 per half gal				
CACAO						
Cacao beans (TCGA & MMC) /lb	S	3.00 dried fermented				
Cacao beans (TCGA & MMC) /lb	S	1.20 wet beans				
US Cacao beans, metric ton	L	US\$ 1,869.40				

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

From My Perch

The Mighty Ceiba - Tree of Life

By Marguerite Fly Bevis



Ceiba pentandra

After Hurricane Earl took down our favorite birding tree, our "Giving Tree," we began to pay more attention to the ceiba tree that had been hiding behind, but stood strong through the storm. This particular tree is rooted at the base of the hill below us which gives us the unusual perspective of a peek into the upper branches of this fascinating tree.



Blooms about 50% open-look carefully for the White-bellied Emerald, *Amazilla candida*

Over time we watched the tree drop its leaves, then bloom with delicate pink flowers that attracted many kinds of birds and wildlife. We then watched the blooms turn to small buds, then larger pods that have now burst open, releasing puffs of cottony clouds, filled with seeds. We have seen squirrels and kinkajous feasting on



Keel-billed Toucan, *Ramphastos sulfuratus*

the pods and birds taking the kapok for their nests. It strikes me how few seeds from this tree actually make it to a proper place for germination. At first the tree was bursting with flowers, thousands of them. Many of the flowers were eaten or knocked off before being allowed to progress to the



Gray Hawk, *Buteo plagiatus* on the nest



Red-ored Parrots, *Amazona autumnalis* groom each other

I finally understand why the Maya referred to this tree as the Tree of Life. At the center of the Maya World was a giant ceiba whose roots begin deep in the underworld and giant limbs reach toward the sky, branches large enough for animals to live in. The tree providing food and shelter for many creatures, large and small, *Ceiba pentandra*, also known as cotton tree, is one of many ceiba species found in tropical areas around the world. *C. pentandra* produces the kapok fibers used in flotation devices and for stuffing mattresses and pillows long before synthetic fibers replaced them. The kapok fibers are also used in nests by birds and even squirrels. The oil from



Deppe's Squirrels feasting on immature kapok pods



Collared Aricari, *Pteroglossus torquatus*

the seeds is nutritious and can be used to make soap. At the end of the fruiting cycle, the pods open up and release fluffy clouds carrying the seeds. It's remarkable how many flowers the tree produces and in spite of thousands of seeds, we don't see very many young ceiba trees. Perhaps it's because the seeds are a source of protein for birds and animals. However once a seed does germinate and lives to be a young tree, it develops thick conical thorns



Laughing Falcon, *Herpetotheres cachinnans*



Pods opening, kapok floating through the air

which deter creatures from eating it. This emergent species can grow to over 200 feet, rising high above the tree line. You can see them in modern pastures, having been left behind as a sign of ancient respect, reminiscent of their cousins, the ancient and massive baobab trees of Africa.



Gray-headed Kite, *Leptodon cayanaensis*



Kapok mound built by squirrels

literally in the cat-bird's seat for documenting a few moments in the life of this magnificent tree. The experience has taught me newfound respect for this mighty giant, this marvelous tree of life.



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**Belize Agricultural Health Authority
Animal Health Department
March 28, 2017
PRESS RELEASE: RABIES ADVISORY**

BAHA informs the general public, but especially cattle producers, that paralytic rabies continues to affect cattle in the Cayo, Corozal and Toledo Districts. The Authority's surveillance programme has resulted in detections of rabies in sheep and also in a vampire bat, in addition to the high number of detections in cattle.



The disease is known to be transmitted by the vampire bat. Therefore, humans, domestic animals and wildlife are susceptible and at risk, especially in the known outbreak areas.

Prevention and control measures are being implemented throughout the affected districts, in close collaboration with the Ministry of Health, the Ministry of Agriculture and the Belize Livestock Producers Association. These measures also require assistance from the general public:

1. **Prevent exposure by not handling any wildlife.** Do not handle bats, foxes and any other wildlife. Farmers should not go into caves, abandoned buildings or rat bat roosting sites to try to control vampire bats. Such dangerous practice can expose them to the rabies virus. While the Ministry of Health is providing post exposure vaccination to humans exposed to the rabies virus, it is best to prevent exposure in the first place.
2. **Vaccination of cattle against rabies.**
 - a. Livestock should be vaccinated using vaccines for which the cold chain has always been maintained. Vaccine suppliers should not sell vaccines unless it is packaged in proper containers to maintain the cold chain. Farmers should keep the cold chain through to the place of vaccination of animals and not use the vaccine after two hours of opening it. **Do not store used vaccines.**
 - b. Cattle farmers are encouraged to vaccinate their young animals once they are 3 months of age. Do not wait until the next vaccination cycle to vaccinate calves born after you have vaccinated the herd.
3. Vampire bats utilize rivers to move between areas; consequently, **farmers with cattle along rivers** (for example, Belize River Valley) **should vaccinate their cattle for rabies** and not wait for a detection to be made in their area before they start to vaccinate!
4. **Vaccinate your dogs and cats for rabies.** The Ministry of Health and BAHA are vaccinating dogs and cats in all outbreak areas at designated vaccination sites. People are encouraged to ensure that their dogs and cats are current in their vaccination for rabies.
5. **Please report all suspect cases in animals immediately to BAHA.**

BAHA, Ministry of Agriculture and Ministry of Health (Public Health) can be contacted in any of their district offices.

Central Farm, Cayo District, Belize, Central America
Tel: (501)-824-4899/72/73 Fax: (501)-824-4889/3773
E-mail: animalhealth@baha.org.bz

SIRDI...Continued from page 16



2. First preventative action utilizing sanitary harrow

This activity is conducted just after the harvesting of the crop (2-3 weeks) and its effect in the field is to expose the eggs of the frog hopper to the direct sunlight for

control, as well as to other natural predators. This exposure of the eggs to direct sunlight causes the desiccation or dehydration and posterior destruction of the eggs, thus preventing the completion of its life cycle. Based on experience, up to 50% of the eggs are destroyed through this activity, which translates to lower cost of pest control.



3. The use of monitoring and control traps

The objective of the use of plastic traps for the control of frog hopper in sugar cane is to be able to monitor nymphs and adults, as well as to provide a physical control. For *monitoring*, the number of traps to be placed in the field is 5 per hectare; while for *control* the number is 100 to 120 traps per hectare. The traps consist of yellow or green polyethylene bags depending on the predominant species:

- Yellow – 570 – 580 nanometers of wavelength
- Green – 540 – 550 nanometers of wavelength

4. Biological control with *Metarhizium anisopliae* and chemical control

The microbiological control can be defined as the utilization of pathogen microorganisms for the population management of pests in the field. This constitutes a major part of the natural control and it can also be manipulated through the introduction of foreign microorganisms to the ecosystem. They coexist

SIRDI...Continued on page 38

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website: www.baha.bz

BAHA
BELIZE AGRICULTURAL HEALTH AUTHORITY

BLPA Holds AGM

The 39th Annual General Meeting (AGM) of the Belize Livestock Producers' Association (BLPA) was held on 25th February, 2017, at their headquarters, Mile 47.5 George Price Highway.



Mr. Abdala Bedran gave the welcoming remarks, which preceded Dr. Henry Canton's Chairman's Address. BLPA General Manager Ms. Elba Cruz also shared remarks and introduced the keynote speaker, Minister Godwin Hulse.



Dr. Miguel DePaz of Belize Agricultural Health Authority (BAHA) gave an update on the BAHA Sweeps 4 and 5, followed by BAHA's Dr. Edwardo

Tesecum, who discussed the current rabies outbreak situation and how the dynamics of the disease in Belize have changed. Drs. DePaz and Tesecum both strongly advised all ranchers to vaccinate every animal for rabies, with 2 doses per animal, on a regular basis, starting with the first vaccination for calves at 3 months age. They noted that BLPA has imported modified live vaccine for sale to their members at a discounted price. Visit or contact the BLPA office as per the advertisement on page 27 to arrange purchase of this vaccine.

International guest Mr. Tom Merritt of the U.S. Quality Beef Assurance (BQA) program shared information about the BQA program. Its goals are to "raise consumer confidence through offering proper management techniques and has a commitment to quality within every segment of the beef industry". They host educational programs for ranchers and "link beef producers with the various specialist sectors interested in maintaining and improving the quality of cattle and beef they produce."



Chairman Canton had earlier alluded to Belize establishing a live animal grading system, and expanding services such as those offered by the BQA. In the US, this is not run as a government program, as funding is sourced from various state and national councils and associations, including the well-known Beef Checkoff.

Mr. Cornie Friesen, the Financial Advisor for the Board of Directors, presented BLPA's financial reports. Overall, the current net assets/total equity of BLPA, after considering current liabilities (\$15,680.00) is \$2,430,285; This is an increase from the total equity for 2015 which was \$2,001,393. Income for 2015 was \$310,540, and income increased to \$775,767 in 2016. The main item contributing to that increase was sales of livestock tags going from \$54,940 in 2016, up to



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\$361,065 in 2016. Other income also increased from \$9,456 in 2015 to \$53,979 in 2016. The total expenses for 2016 were \$308,615; up from \$248,572 in 2015, leaving the net income for 2016 at \$428,891, a substantial increase over 2015's net income of \$42,772.



The elections which always come at the end of the AGM were held with the following gentlemen being elected as new directors for 2 year terms for BLPA: Mr. Henry Canton of Stann Creek; Mr. Arlen Edwards of Punta Gorda; Mr. Richard Penner of Spanish Lookout; Mr. Elston Wade of Belize District; and Mr. Ralph Moody of Belize District. The members of the BLPA Board of Directors who were not subject to election this year, having served only half of their 2 year term, and who remain another year as directors are: Mr. John Dyck of Blue Creek, Orange Walk District; Mr. John Banman of Shipyard, Orange Walk District; and Mr. Ramon Galvez of Cayo District. Mr. Albert Reimer of Blue Creek, Orange Walk District, who had been elected during 2016 as a replacement for Mr. Abdala Bedran who resigned, also remained on as director. At the board meeting following the AGM Mr. Henry Canton was re-elected as chairman; Mr. Ramon Galvez was chosen as Vice-Chair; and Mr. Elston Wade was elected for the joint post of Secretary/Treasurer.

Cattle Auction in Spanish Lookout By Cornie Friessen

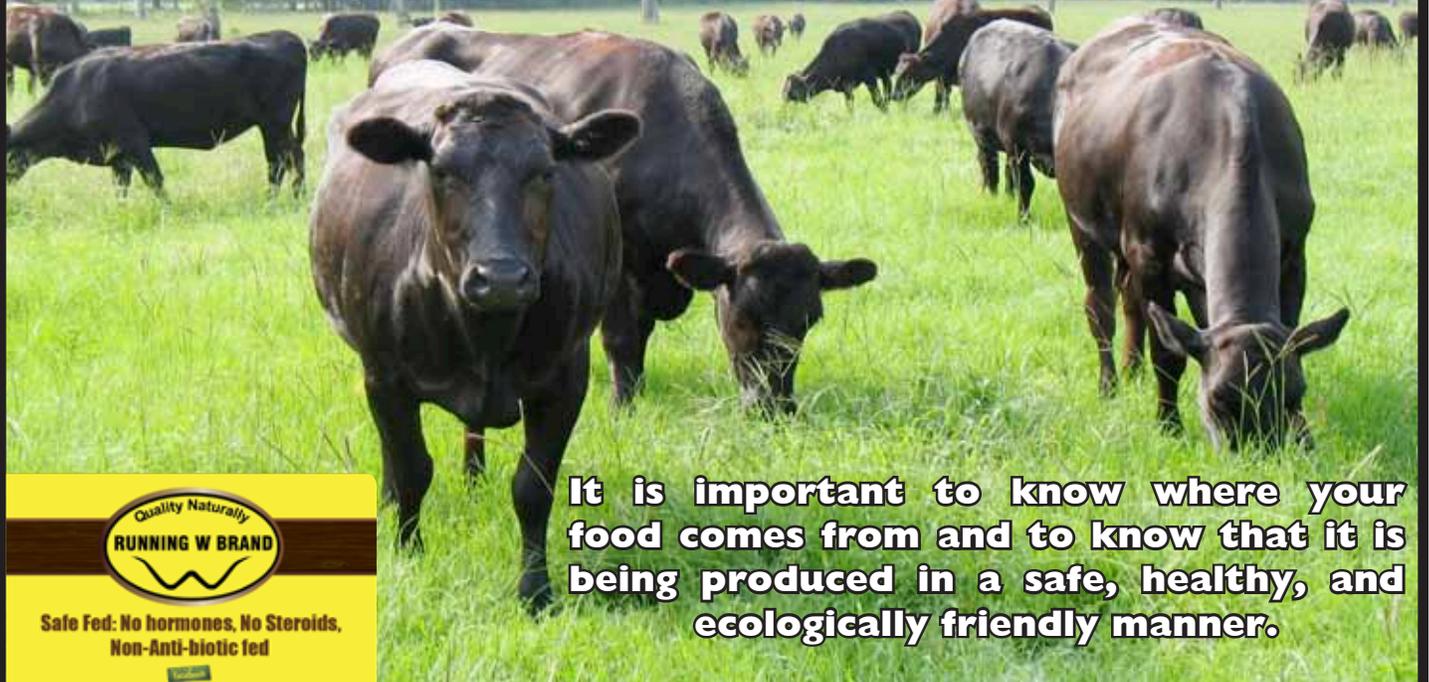


The March 4, 2017 cattle auction was a great success; 37 head of cattle and 3 horses were sold. We were privileged to have some Blue Creek producers bring a load of excellent breeding stock from there as well. There were 15 different owners selling cattle. The cattle were sold to 22 different buyers. Again I estimate more than 300 people came out for the event; 56 individuals registered to buy. People came from all over the country and also Peten, Guatemala. One bull was sold to a Guatemalan buyer. Weather was perfect: overcast with just a little bit of rain but not so much as to really interfere with the auction. Country Meats served us with a delicious steak for lunch.

Auction results: 11 Brahman breeding bulls (20 - 24 months) at an average of 4,745 pounds per bull were sold; the main sellers were Joe Friesen Sr. & KR Ranch from Spanish Lookout. The top price bull was sold by Joe Friesen for \$7,500. 6 Nelore breeding bulls were sold for \$4,085 average per bull; sellers were KR Ranch, John F Dyck from Blue Creek, and Franz Rempel from Blue Creek. The

Auction... Continued on pg. 27

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An Overview of Land Taxes on Agricultural Property Past, Present and Future By Roberson/Feucht

In 2003 the government of Belize (GOB) took a serious look at land taxes, with regard to updating them. Many felt that the existing rates were too high for agricultural/productive sector lands and that owners were discouraged from further agricultural development on them. In 2004, Minister Fonseca signed Land Act No. 5 of 2004, which amended the Land Tax Act, Chapter 58. As well as amending the rates (see chart below from Land No. Act 5), it also redefined several categories which are also covered in the amending act. The law of 2004 included clarifications such as the following new definitions:

1. **“Beach Land”** means land situated along the coast of any mainland and lying within half a mile of the sea
2. **“Cayes”** means all offshore islands other than those (or parts of) which fall within the Town Property Tax Act
3. **“Declared unimproved value”** means the value declared on unimproved land for taxation purposes as set out in the Fourth Schedule

Note: The definition of “Suburban Land”, from the 1983 Chapter 58 of the Land Tax was not amended; it is defined as “land outside the boundaries of a town lying with a five-mile radius of the centre of any such town and any other place which the minister may designate for the purpose of this Act”.

[See Fourth Schedule from the 2004 Act below]

“ FOURTH SCHEDULE Unimproved Value (s. 21)

CATEGORIES	DISTRICTS AND UNIMPROVED PER ACRE VALUE				
AGRICULTURAL	Corozal and Orange Walk	Cayo	Belize	Stann Creek	Toledo
30 acres and under	\$100.00	\$100.00	\$100.00	\$100.00	\$50.00
31 to 100 acres	\$500.00	\$550.00	\$600.00	\$500.00	\$100.00
101 to 200 acres	\$400.00	\$450.00	\$500.00	\$400.00	\$75.00
201 to 300 acres	\$350.00	\$300.00	\$400.00	\$350.00	\$50.00
301 acres and above	\$200.00	\$150.00	\$300.00	\$200.00	\$50.00
SUBURBAN	\$1,000.00	\$1,000.00	\$1,500.00	\$700.00	\$500.00
BEACHES AND CAYES	\$10,000.00	-----	\$10,000.00	\$10,000.00	\$5,000.00
VILLAGE LOTS (one acre and under)	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$500.00

Prior to 2003, land used to be inspected if the owner requested an assessment adjustment for reasons such as unproductive, low-lying, hilly terrain, etc. All these were considered and individually assessed based on inspection visits.

After the new Land Act No. 5 of 2004 came into force, the chart above with valuations by district was used for taxing at 1%. To qualify for the new **“productive sector”** rate, one had to get a letter of support from an agricultural association, and sometimes

an individual inspection of lands was required. A landowner who did not belong to an association sent in a report on production, which sometimes eliminated the need for an on-site inspection. If 30% of a parcel’s acreage was used for cultivation/production the Valuations Department designated it as *productive sector*.

This consideration for agricultural land became informally known by farmers as the **“productive sector land tax”**. However, in the eyes of many, this system was abused. In 2010 the Belize Ag Report visited the Ministry of Agriculture statisticians to obtain the acreages in production by district. With these figures in hand, we visited the GOB Lands Valuation offices, where patient assessors assisted and figured the acreages per acre which were receiving the tax discount at that time. The reasoning and intentions for the article was to show farmers how to receive a discount on their land taxes. The figures revealed a much higher percentage of lands were already benefiting from this tax alleviation than were actually in production, so the information/article never materialized in our publication.

In order to rectify this abusive situation and to create a new taxation system which would be fair to both the landowner and to GOB, Statutory Instruments (S.I.) No. 32 of 2016 cited as LAND TAX (FOURTH SCHEDULE REPLACEMENT) ORDER 2016 was signed on 15th March 2016, Gazetted 19th March and came into force on 1st of April 2016. The tax rate is unchanged, at 1%. What changed are the valuations. See below:

LAND TAX FOURTH SCHEDULE [Sections 2 and 21] DECLARED UNIMPROVED VALUES PER ACRES					
CATEGORIES	DISTRICTS AND DECLARED UNIMPROVED PER ACRE VALUE				
AGRICULTURAL	COROZAL AND ORANGE WALK	CAYO	BELIZE	STANN CREEK	TOLEDO
30 acres or less	\$100.00	\$100.00	\$100.00	\$100.00	\$50.00
31 acres to 300 Acres	\$500.00	\$550.00	\$600.00	\$500.00	\$100.00
301 acres and above	\$600.00	\$650.00	\$700.00	\$600.00	\$300.00
SUBURBAN	\$1,000.00	\$1,000.00	\$1,500.00	\$700.00	\$500.00
BEACHES AND CAYES	\$10,000.00	-----	\$10,000.00	\$10,000.00	\$5,000.00
VILLAGE LOTS (ONE ACRES AND LESS	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$500.00

Under this new 2016 chart, there are changes to land size classifications and an increase of categories. Note the new categories to the agricultural valuations: 1. 31 to 100 acres; 2. 101 acres to 200 acres; and 3. 201 to 300 acres. For example in 2004, a 31 acre parcel of agricultural land in Cayo District in 2004 would be valued at \$550 per acre. The same land in 2016 would remain the same valuation of \$550 per acre. However, a 301 acre agricultural parcel in Cayo in 2004 would have been valued at \$650 per acre and under the 2016 chart is valued at \$150 per acre.

Note: All agricultural lands are taxed as ‘unimproved land’ – for example, there is no difference in valuation for lands which are used for row crops than those which might have a fruit orchard on them.

There seems to be general approval for S.I. 32 of 2016 and S.I. 52 of 2016. However, in our discussions with both private sector landowners and with GOB, we heard many suggestions for inclusion in any new land tax law, which may be discussed by the Lands Review Committee in the Ministry of Finance. For example, some sectors, such as forested lands, logged for the local timber industry, have taken a whopping valuation increase almost tripling their land taxes under S.I. No 32 of 2016, without consideration for the tremendous benefit these forested lands do for our environment – not just pretty to look at but useful in cleaning our waters that filter throughout their watersheds and many other environmental necessities beyond the scope of this article*. We

might question what would happen if Belize's forested lands were sold for subdivision or cleared for expansion of commodity row crops. Many expressed an interest to maintain a fair balance for all our industries and to be encouraged by GOB policies to grow and to increase our exports, while respecting our environment.

New land policy might look at the varying rates of return on the various types of agricultural uses: forestry has at the very least, a 25 year harvest time for their timber crops; fruit tree orchards – avocado, coconut, mango and others need several years for the crops to enter into production; lands in row crops such as beans and corn have a biannual income. All of these factors plus good stewardship of agricultural land might also be warranted for consideration, as is done in many other countries: Is the owner leaving buffers on edges of waterways? Is the owner using excess nitrogen fertilizers which leach through into our waterways and make their way to the sea, damaging our reef? What types and amounts of pesticides are used and how much is being left in the soil as well as leached into the waterways and into the sea? It will not be easy to come up with modifications for a system that would be fair for all and encourage development. However, men have walked on the moon and we have confidence that Belize can successfully meet these challenges.

*PES or Payment for Environmental Services, are financial mechanisms for the maintenance and recuperation of forest cover. These are in place already in many countries, such as Costa Rica, to which we are often compared in terms of tourism and environment, and developed countries such as Japan.

See: <https://www.cbd.int/financial/pes/japan-pesforests.pdf>

http://www.watershedmarkets.org/casestudies/Costa_Rica_National_PES_eng.html

Editor's Note: The Belize Ag Report thanks Mr. Herman Castillo, Senior Valuator in the Ministry of Natural Resources Lands Valuation Office, Ambassador Daniel Gutierrez and Minister Wilfred Elrington for assistance gathering information.

Auction... Continued from pg. 25

top price Nelore bull sold by Franz Rempel was \$6,200. Alvin Hein from Spanish Lookout brought 4 nice young Nelore bulls (yearlings, potential breeders) which sold for \$1,300 average. John F Dyck brought 2 heifers, Nelore/Guzarat cross that fetched a good price of \$3,000 each. We also had some Brangus and Holstein.

It was a good auction and I hope it will continue to happen even if I'm not around for the next time.

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Industrial Hemp as Weed Killer

By Karin Westdyk

New scientific studies claim that glyphosate, found in Monsanto's Roundup® weed killer as well as in other pesticides, is causing serious health problems wherever it is used. These



include but are not limited to: reproductive issues, birth defects, diabetes, autism, non-Hodgkin's lymphoma, Parkinson's disease, Alzheimer's, liver disease, as well as intestinal, digestive, kidney, and autoimmune disorders. The International Agency for Research on Cancer's recent report stating that glyphosate is a probable cause of cancer has made this a priority issue in farming communities throughout Belize.

Glyphosate has been banned in 38 countries and Belize is in the process of reviewing its re-registration. If farmers choose not to use it after weighing the evidence, the big question is: What can we use to get rid of weeds that interfere with crop production?

Old ways meet new ways. According to Dr. D.P. West, who holds a Ph.D. in plant breeding and has spent 18 years as a commercial corn breeder, industrial hemp is an adequate weed control mechanism. In his scientific papers presented at the Conference on Alternative Oilseed and Fiber Crops, West cites the many historical testimonials to hemp's ability to control weeds. For example:

"...it is certain that hemp contributes more than any other crop toward repairing the damage done by its own growth through the return of the leaves to the soil, besides other matters while it is undergoing the process of rotting. Hemp is an admirable weed killer and in flax countries is sometimes employed as a crop in rotation, to precede flax because it puts the soil in so good condition."
--Charles Dodge, Director, Office of Fiber Investigation, 1890.

"There will be little trouble with weeds if the first crop is well destroyed by the spring plowing, for hemp generally occupies all the ground giving weeds but little chance to intrude... In proof of this, a North River farmer a few years ago made the statement that thistles heretofore had mastered him in a certain field, but after sowing it with hemp not a thistle survived, and while ridding his land of this pest the hemp yielded him nearly \$60 per acre where previously nothing valuable could be produced."
--C. Dodge, Hemp Culture, USDA Yearbook of Agriculture, 1895

"Hemp prevents the growth of weeds and other vegetation which would be found on such soils in most other crops or after others are laid by, and its cultivation also seems to make the soil more uniform in character."
--Lyster Dewey, The Hemp Industry in the United States, USDA Yearbook of Agriculture, 1901

"Very few of the common weeds troublesome on the farm can survive the dense shade of a good crop of hemp...In one 4-acre field in Vernon County, Wis., where Canada thistles were very thick, fully 95 per cent of the thistles were killed...."
--Lyster Dewey, Hemp. USDA Yearbook of Agriculture, 1913.

"Hemp has been recommended as a weed control crop. Its dense, tall growth helps to kill out many common weeds. The noxious bindweed, a member

of the morning glory family is checked by hemp."
--B. B. Robinson, Hemp, USDA Agric Bull #1453, 1943

"Among the species studied, the hemp species proved itself to be the best in fiber production. This plant was all the more interesting owing to its low fertilization requirements, and its ability to grow without being irrigated and without chemicals, whether it be for weed or pest control."
--Barriere, et al. 1994 (1)

"Hemp grows quickly, soon covers the ground and chokes out the weeds. So weed control is not necessary."
--Eddy A. A. de Maeyer. 1994 (1)

An experiment in Holland in the 1990s also demonstrated hemp's superior ability to destroy unwanted weeds. In a controlled setting, hemp was shown to be the only rotation crop effective against difficult-to-control weeds propagated by rapidly spreading tubers.

See Belize Ag Report, issue 34, Nov. 2016, *Industrial Hemp Cleans Soil*. Besides choking out weed and building soil industrial hemp has other benefits: harvested hemp can be turned into fuel to run the farm. New technologies exist to convert both cellulose and seed into fuel. (See Belize Ag Report, August 2016, issue 33, *Industrial Uses of Hemp*). It can be used as an effective natural medicine to combat many health issues where modern medicine has failed. (See Belize Ag Report, Feb. 2017, issue 35, *Growing Hemp for Medicine*.)

The story of hemp goes back to the Bible, and its uses throughout history are well documented. Its demise in the 20th century, however, is interesting. During the time of slavery, hemp was noted as one of the main agricultural crops responsible for building the economy of America. Growing, harvesting, and processing hemp at that time was labor intensive; when slavery was abolished in 1865, farmers could not afford to pay for labor and their focus turned to other crops. The invention of the cotton gin by Eli Whitney made cotton the easier crop to grow and it replaced hemp as America's leading fiber export.

In the 1930s a German patent on a machine that processed hemp easily and inexpensively promised a revival for the hemp farmer. But the emerging powerful petrochemical industries were threatened by the potential and set out to ensure that hemp would not survive the onslaught of misinformation touted by the wood-pulp paper and petrochemical industries. Industrial hemp was erroneously lumped in with a very different type of *Cannabis sativa*; however, industrial hemp does not deliver a "high" if smoked - only a possible headache. Furthermore, the single convention treaty, the document that helped to ban hemp throughout the world, clearly states in article 28 that industrial hemp is exempt from restrictions. It's time to consider hemp for weed control.

PESTICIDES CONTROL BOARD
THE PESTICIDES CONTROL BOARD LAUNCHED ITS STRATEGIC PLAN ON APRIL 30, 2017.

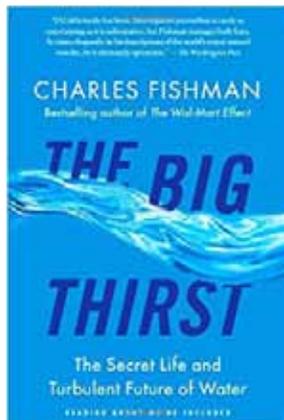
The strategic plan was developed in partnership with the Inter-American Institute for Cooperation on Agriculture, with the support of the United Nations Development Programme and the Department of the Environment through the GEF-funded Belize Chemicals and Waste Management Project.

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The Big Thirst: The Secret Life and Turbulent Future of Water

By Charles Fishman

Book Review By Chris Harris



“The golden age of water is over”. That is the message of this comprehensive account of how we have taken water for granted over many decades.

The fact is that 1.1 billion people of us do not have access to clean safe drinking water, and another 1.8 billion people do not have access to water in their homes. These are statistics [book published 2011] which should give us all pause for thought. And before we shrug those numbers off as a third world problem, we are reminded that Las Vegas, Los Angeles and large areas of

American farmland are also threatened, not just with shortages, but rationing and even running out of water altogether. So this book really is a wake up call to us all.

Fishman has researched and recorded a world wide tale of mismanagement, neglect, bad decision making, wasteful practices, and most telling of all, a failure by politicians from presidents down to see how demand is outpacing our ability to supply this crucial commodity.

It is hard to avoid amazement at the cold hard facts of water use and misuse covered in the very first chapter. However once the reader gets through this torrent of accounts of water’s fundamental part in our daily lives, Fishman takes us through how we got to the point of crisis. To understand how this crisis emerged, we have first to take on board two crucial facts: first, that the same water has been present on Earth for 4.4 billion years and second, that no water is being created or destroyed. That same water, every drop of it, has been endlessly recycled over that time in one form or another. Thus we do not “use up” water, it is in fact indestructible.

So why does he use the word “crisis”? Three key factors are proposed: firstly, the huge explosion in population growth worldwide, all of whom need water to survive; secondly, the impact of periodic droughts - no surprise there; and thirdly, the massive increase in ways we use water, not only for the obvious cooking, drinking and washing, but in an ever-increasing

industrial demand: in cooling towers for power generation, for industrial manufacturing and indeed for large-scale farming.

Despite the stories of mismanagement and lack of forward thinking by politicians, it would be wrong to assume that our leaders alone have caused this problem. And to be fair Fishman does make this point. The hard fact is that water is not evenly distributed across the countries of the world, and sadly neither is the world’s population. There are winners and losers. The book makes the uncomfortable but inescapable point that once water shortages emerge it is very difficult and expensive to redress the situation.

Water is vital to all life on Earth, and yet, as Fishman repeatedly points out, we have all failed to acknowledge its importance to us. We have all taken water for granted. This book posts in the strongest terms just how serious the future is for water to many cities worldwide and ultimately to us all. A very readable book which deserves a wide audience.

The Big Thirst: The Secret Life and Turbulent Future of Water by Charles Fishman, 2011, is published by Free Press, 1230 Avenue of the Americas, New York.

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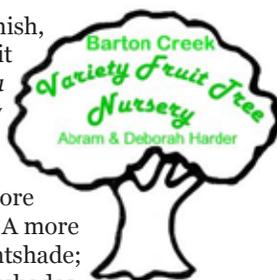
Berries of Belize

Part 1: Solanum Nigrum

AKA Hierba Mora

By Deborah Harder

The Mayas call it *chayuk*, but the Spanish, emphasizing both the leaf and the fruit in the name they gave it, called it *mora* after the Spanish word for blackberry or mulberry. In English we have been calling the fruits blueberries or wild huckleberries which they resemble more than either fruit in the *mora* category. A more correct English translation is nightshade; however since there are many nightshades, including tomatoes, potatoes, and eggplant, that name doesn't narrow it down much. But let's not worry much about names and turn to culture and usage. Indeed, useful and under-appreciated, *hierba mora* is a plant bearing both edible leaves and fruit.



Hierba mora is normally not cultivated; it grows wild, often coming up on burnt land and plowed land and growing profusely, winter and summer. You can recognize this "weed" which grows to a small bush bearing blue-black berries, by the distinctly purple underside of the leaves. However, the seeds from the ripe berries can be sown in trays and planted in a garden about 3 feet apart. Like other nightshade plants, they are an annual plant which can be planted any time weather conditions are favorable. They do not fruit according to a season. For planting in a garden, both summer and winter work well.

Mayas prize *chayuk* even more for the leaves than the fruit. No matter what suspicions the over-educated may have about the toxicity of nightshade leaves, the Maya have been using them as a potherb since time immemorial and consider it especially nutritious and healthful. They are generally boiled first, the cooking water also consumed as a nourishing tonic. The leaves are generally eaten with corn tortillas, its slightly bitter flavor relished by its admirers. For those who like their greens dressed up a little more, boiled *chayuk* can be fried with eggs, meat, tomatoes, peppers and onions, or whatever you desire. Naturally, if you want your *hierba mora* to bear fruit, you should not overharvest the leaves.

Blueberries have been preserved by canning; however, for some reason they seem to be tricky to can, requiring more sugar and

a longer cooking time than most other fruits. Perhaps they are lower acid than their taste suggests. More research is needed to give exact canning directions. But meanwhile, cooked, sweetened blueberries can be dried to produce something like raisins. They can be used as a raisin substitute in any recipe. Whole blueberries can be cooked for several hours with almost an equal amount of sugar to produce a nice jam.

The berries are sweet and delicious when eaten out of hand; blueberry pie is also prized, though for some reason these berries seem to call for a lot of sugar for pie. Coffee cake is also good, so try the recipes below.



Blueberry Pie

- 1 unbaked pie shell
- About 3 cups blueberries
- 1 cup sugar

Fill the pie crust with berries and sugar. Cover with a top crust, if desired. Bake for about 1/2 hour, till the crust is brown and blueberries are bubbly.

Blueberry Coffee Cake

- 1 cup sugar
- 1 egg
- 1/2 cup butter
- 2 cups ripe, raw blueberries
- 2 cups flour (cassava flour works well)
- 1/2 teaspoon cinnamon
- 2 teaspoons baking powder
- 1/4 cup nuts (optional)
- 1/2 cup milk

Using either a pastry blender or 2 forks, cut together the sugar, flour and butter until the dough is crumbly, about the size of small peas. Remove 1/2 cup and set it aside for the top. To the remaining crumbs add baking powder, then milk, egg and blueberries. Spread in a greased 9 x 9 x 2" baking dish. Add cinnamon and optional nuts to the reserved crumbs; sprinkle on top. Bake for about 1/2 hour or until done (no dough on toothpick inserted in the middle of the cake for testing).

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Coffee in San Vicente Toledo District



Marcus Kal

Approximately 8 miles northwest from Jalacte, Toledo District, and resting in the hills along the Belize- Guatemalan border, sits the quiet off-the-grid village of San Vicente, a primarily Maya Ketchi community of about 35-40 family farms, where cultivation of black beans, organic cacao and the recent addition of organic coffee are the mainstays.

Efrain Caal, local farmer and TCGA (Toledo Cacao Growers Association) extension officer, met us as we arrived in the community and introduced us to Marcus Kal, one of the leading farmers of the newly formed San Vicente Coffee Growers. In 2006 Marcus started transforming a completely cleared hillside, previously a cattle pasture, into an organic multi-cropped orchard (see cover photo). First he planted madre cacao and mahogany, establishing shade for the future crops. Soon after, 'Maya Red' cacao (a CATIE hybrid trinitario variety) was planted, then Caturra coffee and finally cardamom filled the remaining available spaces, creating a diversely intercropped orchard of several high-income organic niche products.



Marcus' farm includes about 3,000 coffee trees and other farmers of the village together have roughly an additional 10,000 coffee trees. All the San Vicente coffee trees are *Caturra*,

which is a variety of *Coffea Arabica*. In Guatemala, roughly 38% of the coffee is *Caturra*, and in Costa Rica, it's about 90% of their total production.

The San Vicente Coffee Growers currently have about 400 to 500 lbs. of organic green unroasted coffee beans available monthly. This will rise in the future as trees mature and more orchards are planted. See their ad this page for contact information.

The village's primary school has its own cacao orchard with over 500 cacao trees and the village together markets about 5,000

lbs of fermented dried cacao beans to TCGA. Black beans are the main crop for their region, with about 200,000 lbs. grown annually.

Efrain and Marcus stated that much of their community's agriculture is already organic, and that their vision is for more farmers to convert to organic, maintaining the fertility of the region into the future and qualifying their products for the higher prices which organics earn.



Efrain Caal and Marcus Kal

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The Wonders of Green Coffee By Kimmer Ringland, CMH



Several years ago I wrote an article for the Belize Ag Report about the benefits of used coffee grounds in the garden. In this article I would like to talk about green coffee and the reported health care properties. The coffee and its beans have a reputation as a dark, rich drink that many enjoy for its “pick me up” property in the morning and during the day. The beans must be roasted to achieve the desired effect and flavor. Unfortunately during the roasting process many of the benefits which occur naturally are

lost. The Arabica coffee plant produces two hard green seeds or beans per coffee “cherry”. These are fermented, cleaned, dried and bagged. Now they are ready for the roaster. In this form, green, coffee is very medicinal.

First, it is known as an antioxidant, cardiac and cerebral stimulant. Green coffee contains 28% caffeine, much of which is lost during roasting; in its raw form though it is hard to access yet is an amazing metabolizer and helps to detox the liver of harmful fats. But there is so much more. For example, it helps to control blood sugar. Green coffee contains chlorogenic acid, a compound that increases the body’s ability to access blood sugars and maintain healthy levels. Many people tend to lose weight as their metabolism is increased and accesses fats during the process. After the age of 40 our bodies are designed to slow down metabolism and store the energy as fat for our old age. Having 24/7 access to food sources, rather than seasonal

hunting and gathering of the historical past, people of our modern society tend to gain weight and develop many illnesses, including type 2 diabetes and all the health concerns that accompany this life-endangering disease.

Green coffee and its ability to suppress appetite can help many people maintain healthy weight levels, which can lead to a longer, higher quality of life. To use green coffee you must grind it, which can be difficult, as the bean is very, very hard. Once ground, use 1 teaspoon for every 8 oz. of water and boil for 20 minutes. Drink as often as you like during the day. A couple of cups a day are great for the “boost effect” and may be very beneficial for the waist line. Add a little cinnamon and you increase its effect and create a wonderful cup of tea.

Green coffee and its beneficial compounds are also used in hair loss formulations and many skin care products.

Many anti-aging products use green coffee extracts as it slows down the effects of free radicals from pollution and daily living, thus reducing damage to skin. These extracts are antioxidant and also contain gamma-aminobutyric acid (GABA), theophylline, and many other compounds that are excellent for general skin care as well as boosting the immune system.

This is only a small sketch of the wonders of green coffee. Many other uses are out there, as there are numerous beneficial components in unroasted green coffee beans. Explore and enjoy this local herb.

Green Coffee Recipe: fill your stainless steel or cast iron pot with one part coffee beans to six parts distilled water. 2 oz of coffee beans and 12 oz of water is a good amount for your first batch. Bring the beans and water to a boil, then reduce the heat and allow the solution to simmer for 20 minutes.



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Senior Scientist and Professor from MIT Visits Belize



Mrs. Suad Holder, Dr. Gordon Holder, head of UB's College of Agriculture, Dr. Stephanie Seneff and her husband Dr. Victor Zue

It was a rare privilege to welcome Dr. Stephanie Seneff, Senior Research Scientist at MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) in Cambridge, Massachusetts, U.S. and her husband, Dr. Victor Zue, Director of International Relations, CSAIL and former director of the lab. Dr. Seneff's recent focus on the role of toxic chemicals and micronutrient deficiencies in health and disease, with a special emphasis on glyphosate and the mineral sulfur brought in-depth scientific knowledge to our understanding. Having authored over two dozen peer-reviewed journal papers over the past few years on these topics, she shared her findings on KREM and LOVE TV, and in presentations in Spanish Lookout and University of Belize

College of Agriculture at Central Farm (UB/CF) and to Belize's Pesticide Control Board (PCB) as input to their re-registration and review process.

The sponsoring organizations, including Pro-Organic Belize, Belize Wellness Institute, Belize Botanic Gardens, Belize Organic Family Farming, Plenty Belize, Sustainable Harvest International-Belize, the Southeast Watershed Alliance Group and UB/CF, are eager to (1) educate Belizeans on the adverse effects of glyphosate on the health of humans, animals, birds, honeybees, butterflies, fish and other sea creatures, and wildlife, as well as our soil, water and forests, (2) urge them to stop using glyphosate and (3) stop eating foods sprayed with glyphosate. It is not possible to wash the glyphosate-sprayed foods, as the chemical has systemic action and is in every cell of the produce*. Research shows that residues are typically found on crops which are desiccated with glyphosate before harvest, including: wheat, corn, soy, sugar, beans, and cereal grains such as oats in Canada and the U.S. The incidence of birth defects, cancer, autism, miscarriages, Parkinson's disease, diabetes, Alzheimer's disease, leukemia, non-Hodgkin's lymphoma, intestinal disorders, digestive problems, autoimmune disorders, lupus, arthritis, chronic kidney disease, impaired thyroid function, hydrocephaly (small head) & cleft pallet, hyperactivity/obesity, and lowered sperm count are all on the rise. She urged Belizeans to consume less imported processed foods and to encourage healthy agriculture practices here so that Belize will not follow the American trend which has led to an epidemic of health problems there.

*Currently Belize has no regular system of testing either domestic or imported produce for pesticide residues. The WTO regulations prohibit Belize from requiring imported produce to be tested until we test our domestically grown produce.

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Inga Alley Cropping: An Innovative Method for Sustainable Agriculture

By Stephanie Smith, Sustainable Land Use Manager, Ya'axché Conservation Trust



Many people have recently been asking the question of how to provide food for the growing Belizean population and protect the livelihoods of farmers while also maintaining the natural resources that attract tourists, providing jobs

to a large number of Belizeans. How can we most efficiently use the land that is being farmed to produce a high yield without constantly needing to expand further into forested areas that benefit the agriculture industry and the country?

Part of the solution may lie in inga alley cropping, a farming method that is being introduced to Belize after decades of testing at the Inga Foundation in Honduras. Whereas the traditional

slash-and-burn practice involves rotating fields and has led to increased deforestation in some areas, inga alley cropping can be used to grow annual crops on the same piece of



land for twenty years without the application of chemicals. This revolutionary method uses leguminous inga trees, locally known as bri-bri, to replace nutrients in the soil naturally. The inga trees are planted in rows, which after eighteen to twenty-four months create a canopy that shades the ground and prevents weeds from growing in the alleys between the rows. Once the canopy has formed, the trees are pruned, releasing nitrogen into the soil through the roots. The trimmed branches can be used as firewood, and the leaves are left on the ground to create mulch. Any annual crop, such as corn, beans, or pineapple, can then be planted in the alleys while the inga grows back to form another canopy and repeat the cycle.

The benefits of this amazing method are numerous. A farmer doesn't need to clear more land every two or three years, nor does he need to apply fertilizers to continue planting on the same plot. He will not need to use fire, which means less risk for him and less threat of escaped fire burning the crops that provide livelihoods for his neighbors. In addition to the annual crops he grows, he can sell the firewood he collects, as well as the inga fruits and/



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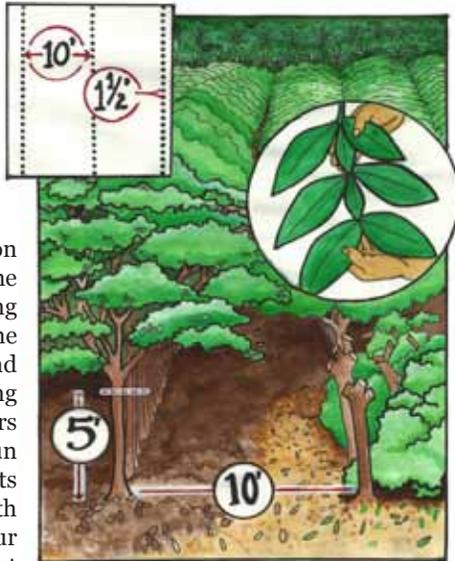
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or seeds. Also, inga can be used to prevent soil erosion on slopes and near waterways, which helps preserve the soil quality as well as water quality.

Ya'axché Conservation Trust is pioneering the inga alley cropping method in the Toledo District and is currently working with eighteen farmers who have begun establishing inga plots on their farms, with plots ranging from four months old to almost

two years. Some of the farmers have planted corn in the alleys while the inga grows to full height in order to take advantage of the space, and all are very excited to prune their plot for the first time. Mr. Mateo Ack of Medina Bank Village was recently recognized for his outstanding example and dedication at an inga forum organized by Ya'axché, and a number of demonstration plots have been established in the Toledo District so that when the plants reach maturity, interested individuals can see the method in action.

To learn more about inga alley cropping and other sustainable agricultural techniques, visit www.yaaxche.org.



Pro-Organic Belize meets on the first Thursday of every month at Maya Mountain Lodge (MML), Cristo Rey Rd, Cayo District. Our business meeting begins at 11 am, followed by lunch at noon off the Nature's Kitchen Restaurant menu at MML. The highlight of these gatherings is the speaker who begins at 1:15 in MML's air-conditioned conference room. These are inter-active presentations with much discussion. All are welcome and there is no charge.



May 4, 2017 – Mr. Chris Harris owner, with his wife Sue, of White Rock Farm, located off the Hummingbird Highway South of Belmopan, will speak on *Retiring to a Small Farm*. He will discuss setting up their farm in Belize, the things he and Sue got right and the things they did not, towards creating a self - sustaining farm.

June 1, 2017 – Dr. Anabel Ford, president of Exploring Solutions Past – The Maya Forest Alliance, will speak on *Maya Gardening and the Maya Forest Garden*.

July 6, 2017 – Dr. Johnathan Canton and Amy Jenine Wong of Kunahmul Organics will speak on *Growing and Marketing Challenges of Organic Production in Belize*. Johnathan will discuss the biological perspective and Amy will address marketing challenges.

August 3, 2017 – Ms. Chrissie Tupper of Cheers Restaurant and owner of the farm behind the restaurant (which sources most of the eggs served at Cheers) will share her experiences *Getting Started with Backyard Poultry in Belize, including Chickens of Various Breeds, Ducks, Guinea Fowl, and Geese*. Bring your questions!

If you are interested in joining the Pesticide-Free Co-op for weekly pesticide-free produce stop by the Belize Botanic Garden Shop on West Ave. San Ignacio some Tuesday 1:30 - 3:30 or John's Top Meats (Green Grocer) 2:30 - 3:30 in Belmopan and talk to us.

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AG BRIEFS



It may seem early, but booking well ahead of time is necessary to schedule **soil fertility expert Neal Kinsey's return to the University**



He developed the Belize Export Platform for the promotion of trade and the competitiveness of small and medium size agribusiness. He also initiated and was instrumental in the discussions for the strengthening of the Sugar Industry Research and Development Institute (SIRDI) and the development of a National Livestock Registry.; Both of which are active today.

of Belize College of Agriculture. The next course dates are 3,4 & 5th September 2018. This course will be a repeat of the very well-received Intro 2 course given in February of this year. All are welcome to attend. Farmers, students, teachers and agronomy consultants are encouraged to take advantage of this opportunity. Beginning with micro-nutrients and working back to the main nutrients, this course features interpretation of actual soil tests and has been a favorite of farmers worldwide. Contact David Thiessen at 670-4817 or thiessenliquid@gmail.com. Limited registration.

The Chocolate Festival of Belize will be held in Punta Gorda Town, Toledo District, on Commonwealth Day Weekend, 19th - 21st May 2017. For information on tickets see ad on page 32.



The Belize Wellness and Fitness Fair will be held on 27th May 2017 at the San Ignacio Welcome Center. For more information call 674-1919.

Hopkins will again host **The Mango Fest** on 3rd & 4th June, 2017. For more information contact damian_grieco@yahoo.com.



IICA In March 2017, **Belize welcomed back Dr. Gabriel Rodríguez Marqués, a citizen of Uruguay, as the new country representative for the Inter-American Institute for Cooperation on Agriculture (IICA).** Dr. Rodríguez Marqués served as country representative in 2009 to 2010 during which period he supported the tourism sector study which led to the development of a tourism master plan for Hopkins.



April 20 was an important day for the Pesticide Control Board; it was the official launch of their 5 year strategic plan developed in partnership with International Institute for Cooperation on Agriculture (IICA) and with the support of the United Nations Development Programme (UNDP) and the Department of the Environment (DOE) through the Global Environmental Facility (GEF) funded Belize Chemicals and Waste Management Project. The entire strategic plan is on the PCB web site www.pcbbelize.com. The plan, developed under the direction of Dr. Dowlatt Budhran, former country IICA representative, was initiated when both Miriam Serrut, PCB Registrar and Dr. Budhran recognized the necessity of it and went to the late Anhil Sinha, who was the chairman of the PCB board, for help. A description of the plan development is scheduled for the August issue of the Belize Ag Report.

For Information on the status of the **Iguana Creek Bridge**

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

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

Local and Regional Fuel Prices



	Cayo, Belize	Quintana Roo, Mexico	Peten, Guatemala
REGULAR	↑ \$10.36 Bz/Gal	↑ \$6.27 Bz/Gal	↑ \$7.57 Bz/Gal
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DIESEL	↑ \$9.48 Bz/Gal	↑ \$6.67 Bz/Gal	↓ \$6.12 Bz/Gal



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The EMTs are trained to meet or exceed standards set by BERT and are retested every year. We've also been giving First Aid classes to schools and other organizations.

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Although **India** is identified as the world's 2nd largest producer of fruits and vegetables, it is estimated that about 40% of their production goes to waste. To rectify that, **the Indian government will help establish regional clusters with cold chain facilities.** Currently only 2.2% of India's produce is processed and currently about 80% of existing cold storage facilities are used for potatoes only.

Note: The GOB has built cold storage which can be used by small produce farmers at of the newly renovated NATS showgrounds.

In late April **Oaxaca, Mexico** noted that **HLB has decreased their lime production by 40%.** Prices regionally rose (Belize retail prices hit \$0.75Bz per lime) as production suffers from this disease without a cure.



Avocado growth: Jalisco, Mexico, currently with 22,000 hectares of avocado production, announced that they have experienced a 21.3% increase in production for each of the past 16 years; in 2000 only 1,000 hectares were planted with avocado.

New avocado variety: the Adalgiza avocado has been officially recognized in Brazil.



Compared with the hass variety, the fruits are said to be more buttery, less fibrous, and more rounded in shape. The trees themselves are also of a different shape, with the fruits growing more in the treetop area, where they are more protected than the hass. Grower Helio Hilton Rezende (heliohiltonrezende@yahoo.com.br) has been developing this variety for over 15 yrs and is in discussion with US and South African growers for export.



Peru reports that Cavendish Valery plantain exports have increased by 89% in the past 5 years, rising from US\$80M in 2012 to US\$152M in 2016. The primary purchaser is the Netherlands, followed by the USA, Germany and Belgium.

Germany: Many retailers are requiring European packagers to use wooden and pulp recyclable biodegradable containers for produce. The organic material products guarantee better aeration and maintain the hydration of the produce, extending shelf life.



Colorado, USA: In April 2017, an appeals court upheld the conviction for 'trespassing with pesticides' against adjacent landowners and people with health sensitivities. The farmer who continued fogging his property with pesticides, ignoring the 2012 court ruling which prohibited him for continuation of this practice, will now not only pay a US\$7,500 fine, but also serve 14 days in jail.

Researchers at the University of Almeria, Spain, show that **the reddest, smoothest and roundest tomatoes are the most effective against colon cancer.** All tomatoes prevent somewhat the proliferation of colorectal cancer cells, but the more deeply colored types contain higher amounts of both lycopene and fatty acids. They also confirm that the combination of olive oil with tomatoes increases benefits significantly as the polyphenols of the oil synergistically add to the preventive actions of tomato components such as lycopene.




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SIRDI...Continued from page 23

inside the same pest habitat, and are capable of causing them damage or death; microorganisms have become a major tool in the management of various agricultural pests. Some of the microorganisms used for the management of pests are bacteria, viruses, fungi, protozoan etc. Close to 80% of the diseases that affect insect pests are due to fungi, existing over 90 genus and 700 species.



The biological control of frog hopper in sugar cane constitutes the pillar of an IPDM program. Entomopathogenic fungi are applied in the field as soon as the first rains fall since they provide the adequate temperature for increase in fungi population. These fungi are capable of causing disease to the insect, weakening it since it does not feed and causing it to die. When a fungus is applied it takes approximately 2 to 3 days to affect the insects. It is always recommended to apply it during the late hours of the day since the sun can cause dehydration and kill the fungus.



IPDM is a holistic approach to sustainable agriculture that focuses on managing insects, weeds and disease through a combination of culturing and chemical measures that are cost effective, environmentally sound

and socially acceptable. There are 3 stages of IPDM: prevention, monitoring and intervention. At the prevention stage farmers must understand the ecological conditions, select varieties appropriately and manage their crops. At the monitoring stage farmers must inspect fields, identify issues and determine action. Farmers must be aware that both prevention and monitoring work vice versa and complement each other. At the intervention stage farmers must avoid the use of chemicals that are harmful to human beings and the environment. The wise choice for IPDM of frog hopper is the use of the fungus, *Metarhizium*.

ABOUT SIRDI EU IPDM PROJECT

SIRDI and the EU have an 18 month agreement for the specific objective of strengthening IPDM in the sugar industry. The project will enable SIRDI to build capacity in the areas of IPDM research and development, while ensuring its sustainability through the provision of technical services.

EXPECTED RESULTS

1. Effective IPDM unit established with human resources, laboratory facilities and service provision with an early warning system serving the northern sugar belt.
2. Capacity of sugar cane farmers, associations and SIRDI strengthened on best practices in IPDM.
3. Field demonstration plots established to validate agronomic techniques in IPDM for participating cane farmers.

The IPDM laboratory will be a first-ever entomology and pathology laboratory facility in Belize with the equipment and supplies required for the production of biological control agents,

which is a critical component of the IPDM system. The lab will use an approach that carefully and intelligently selects and uses pest control actions that ensure favorable economic, ecological and sociological consequences. The main activities of the lab will include collecting, isolating and multiplying an indigenous strain of entomopathogenic fungus *Metarhizium* present in the Belize eco-system. The various formulations of *Metarhizium* bio-pesticide will be accessible to farmers in the sugar industry at a low cost.

Special thanks to SIRDI and the IPDM unit staff for making the SIRDI EU IPDM Farmers Seminar a success.

Errata, Issue 35, Mycorrhizae, pg. 10

The Belize Ag Report apologizes to contributor Dr. Johnathan Canton and readers for inadvertent editorial changes to the article *Mycorrhizae: What are they and can they give me better crops?* on page 10 of issue #35 of February 2017. Kindly read below to see the author's corrections. The corrected version appears on our website.

The first sentence of paragraph 1, defines a symbiosis as «the living together of two dissimilar organisms with mutual benefit». This statement describes only one form of symbiosis - mutualism. Symbiosis is more accurately defined as two species living together for an extended period of time. In some instances mutual benefit is not observed.

The first sentence of paragraph 1 also states that mycorrhizae have «substantial agricultural usefulness». The author wishes the readership to know that his intention was to use more subtle wording, as the «substantial» agricultural usefulness of mycorrhizae has not been definitively agreed upon in the peer-reviewed scientific literature.

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