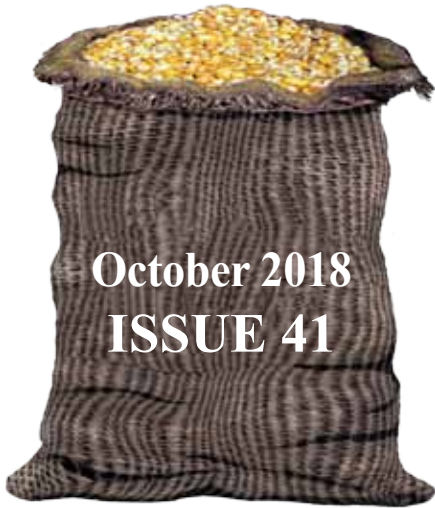


The Belize Ag Report

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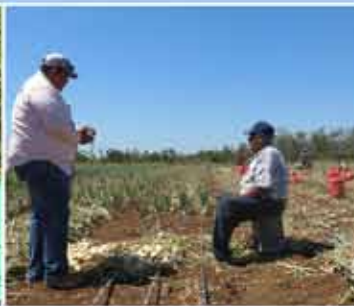
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Passionfruit By Taylor Walker

Kingfisher Regenerative Agricultural Services



Passionfruit is one of the fastest growing and most worthwhile fruit for Belize. Passionfruit belongs to the diverse *Passifloracea* or Passion Flower Family, which contains around 600 species of flowering herbaceous vines. Of these 600 known species of *Passiflora*, many are grown worldwide in tropical and

subtropical gardens for their extremely unique and beautiful flowers. Only 30 *Passiflora* species are known for producing good quality edible fruits. Purple passionfruit, *Passiflora edulis*, and Yellow passionfruit, *Passiflora edulis flavicarpa*, are some of the most productive and desirable. Passionfruit plants are fast growing herbaceous vines that use tendrils to grip onto other plants and objects to grow toward the sun. Passionfruit are quite unusual with a fruit arrangement that is visually and botanically similar to pomegranate fruit. The hard leathery shell or rind of the passionfruit incase many midsize black seeds, surrounded by a translucent juicy pulp. The pulp can be eaten out of hand, especially the sweet varieties. The more sour cultivars are best for processing. The pulp is most easily removed from the seeds by lightly blending with a little water and straining out seeds. The taste of the pulp or juice is spectacular with a citrus and guava like flavor combination ranging in acidity from slightly tangy to very sour. The juice is often mixed with water and a sweetener to make a drink, processed into jelly, or added into ice cream. The sweet and sour flavour also lends itself well to sauces, marinades, ceviche, ideals, frozen drinks, and various sweets.

Besides the delicious taste of the fruit, growers will delight in the rapid growth and precocious bountiful harvests from a passionfruit vine. Vines can grow over 100 feet in length in the first year and produce hundreds of fruits. The passionfruit vine can easily climb and engulf a 30 to 40 foot tree within one year. A great way to grow passionfruit in your yard or farm is to use an existing undesirable or dying tree as a support trellis. On tall, large diameter trees with no low branching you need to use a thin bamboo pole or bush stick with side branches as a bridge to help the passionfruit reach the canopy of the larger tree. The passionfruit vine cannot grab, twine, or

climb large diameter plants or objects and must be provided with suitable trellis wires or host trees along with proper growing conditions in order to produce a good harvest. Old unproductive citrus trees can provide an excellent trellis for passionfruit that come into production in the first year after planting. This method has become popular in parts of southern California and Florida where Citrus Canker, Citrus Greening (HLBG) and other plant diseases have wreaked havoc on much of the citrus industry and farmers need replacement crops in many of these production regions. Passionfruit is considered a viable alternative for the failing citrus industry in Florida, Brazil, California, and Belize. Passionfruit are very adaptable here in Belize, handling high heat, heavy rain, prolonged drought, and pest resistance. Vines are grown from seed, cuttings, and grafted plants with most commercial-sized operations working with grafted plants on the Yellow passion fruit root stock. Yellow passionfruit is the most vigorous, and disease-resistant variety, making it the obvious choice for root stock in grafted plants.

There are many positives with passionfruit as a commercial crop, but we also must consider the negatives or disadvantages of the crop. The vine is very fast growing but it is also quite short lived with a productive life of 2 to 6 years. Various viruses and fungi can affect the vines with the ability to cause rapid decline of the entire plant. Root Knot nematodes (RKN) can also be an issue in many growing regions but are being combated by using RKN-resistant rootstocks to graft with highly productive varieties.

Fruit are typically produced over a long season and some cultivars can be ever-bearing, although the vines seem to produce the most fruit in spring and fall. Fruit ripen and fall to the ground when they are ready. Their tough, leathery rind provides great protection and the fruits can fall from considerable heights without damage. Collecting the ripe fruit off the ground provides a harvesting challenge as well as a maintenance challenge as the fruits should be picked up daily or every other day during harvest season. The ground must also be kept mowed or chopped during harvest season so the fruits are easy to collect. Fallen ripe fruit left in the sun blister and degrade rapidly, while fruit promptly harvested and stored in cool shady area keep for up to 10 days. If the fruit is for fresh market sale and is not destined for processing, harvest fruits at full ripe color, which varies depending on variety.

Continued on page 5

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Belize National Biodiversity Strategy and Action Plan (NBSAP) Launch

By Dottie Feucht



Dr. Omar Figueroa

The launch of the NBSAP on May 31, 2018 coincided closely with the 25th anniversary of the United Nations Convention on Biological Diversity (CBD). As one of the signatories numbering 195 countries plus the EU, Belize implemented its pledge to conserve biological components in several phases

including the development of the NBSAP, a five year action plan of the national biodiversity goals. The celebration of the launch of NBSAP was held in Falcon Park in San Ignacio, attended by dignitaries as well as students in the area. Besides the exhibits of conservation projects and organizations, the program included action: His Lordship, Mayor Earl Trapp, and Minister of State of the Ministry of Agriculture, Fisheries, Forestry, Environment, Sustainable Development and Climate Change (MAFFESDCC), The Honorable Dr. Omar Figueroa, each planted a tree, 2 of the 1,000 trees to be given to San Ignacio by Forestry. Ms. Rasheda Garcia of Forestry says the goal is to plant 10,000 trees all over Belize by 2020. Forestry's urban green-space initiative is part



of their *Forest for Life* campaign being promoted under the Key Biodiversity Areas Project, aimed at promoting forest stewardship and building climate resilient communities. A commitment to plant

the trees was backed by a certificate signed by Mayor Trapp, Dr. Figueroa and Wilber Sabito, Chief Forestry Officer. San Ignacio is the third municipality, joining Belmopan and Orange Walk in signed commitments to plant the donated trees.



Initiatives already in place in San Ignacio extend beyond plants to make San Ignacio greener; Mayor Trapp reported on a project to filter grey water from the drains to form a wetland area as a habitat for wildlife and solid waste management services free to the people of San Ignacio.

Dr. Figueroa said the NBSAP sends a clear signal that Belize is serious about conserving for sustainable use our natural resources. As a matter of fact, Belize exceeds CBD requirements in the amount of protected land in our country. Chief Executive Officer in MAFFESDCC, Dr. Percival Cho, said the government of Belize has invested \$96 M as part of its commitment to achieve its biodiversity goals and as a signatory of the CBD, Belize committed to ensuring that its biodiversity is sustainably used for the benefit of all. In 2016 the ministry began to lead the process of preparing Belize's NBSAP.



The recent establishment of a biological corridor for wildlife in northeast Belize is an example of the legacy of stewardship being developed by Belize. Mistress of Ceremonies, Mrs. Judene Tingling-Linares, reminded the attendees that the next

25 years belong to the older students in the audience and the 25 years after that belong to the adorable pre-schoolers who proudly sang the national anthem to open the celebration and performed a skit to the delight of the audience.

Photos by Orlando Pulido

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.

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Passionfruit Continued from page 3



There are other noteworthy edible Passiflora species for the home gardener or small farmer. The clear difference between these species and the more popular *P. edulis* is their reduced yield, vigor, and adaptability. Giant Granadilla, *Passiflora quadrangularis*, is the second most common passionfruit grown in Belize with very large fruit up to 3 pounds, possessing a much more mild tasting pulp and a very thick rind that is often peeled and stewed with sugar. Sweet Granadilla, *Passiflora ligularis*, is more similar in size to Purple passion fruit, but lacks the acidity of the other species and is best for eating fresh out of hand.

There is still work to be done in Belize before passion fruit is a truly viable citrus alternative. Known productive and resistant varieties need to be identified and obtained. Central and South America are the points of origin for the passion fruits and have the most varieties and species. Because the plants come into maturity so rapidly and can be grown from durable seeds, trialing and evaluating cultivars for commercial viability can be done rather quickly and inexpensively compared to most fruit crops. The local market is also wide open as very few growers produce passionfruit in Belize. The common varieties of Yellow and Purple passion fruit, already available here, are definitely worth growing for your home use or local market sales. Passionfruit plants can be purchased at All Fruits Nursery in Springfield, Cayo and at Belize Botanic Gardens nursery. Go out and plant a passionfruit; you will not be sorry!

Passionfruit photos courtesy Belize Spice Farm.

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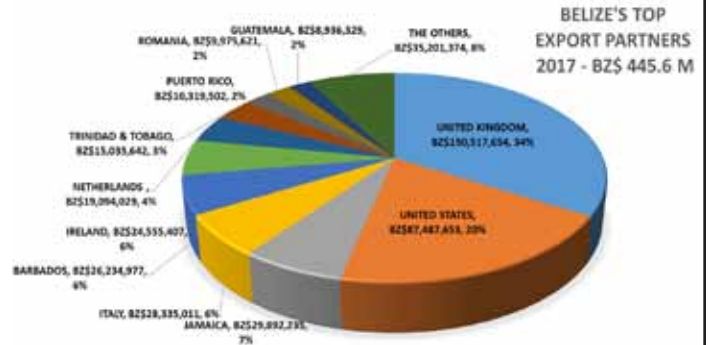
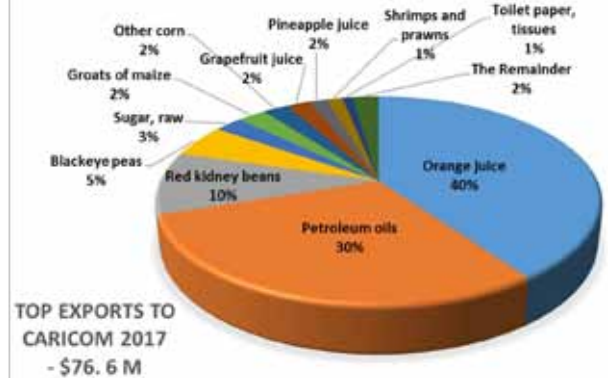
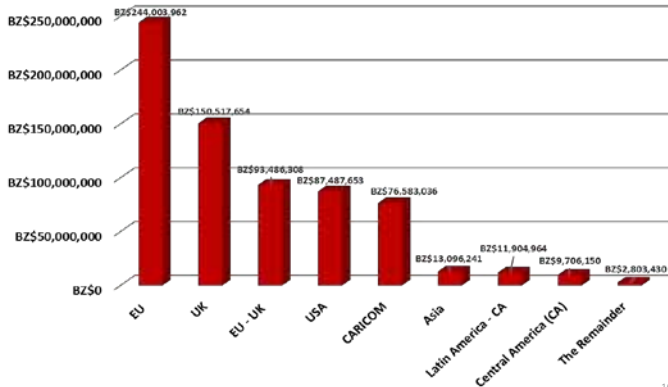
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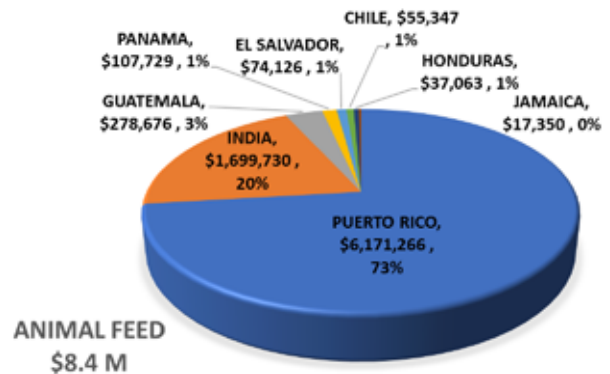
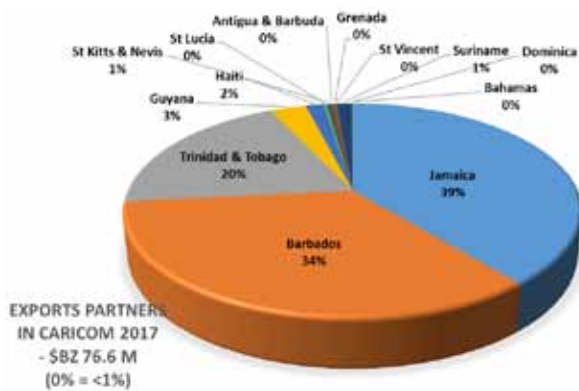
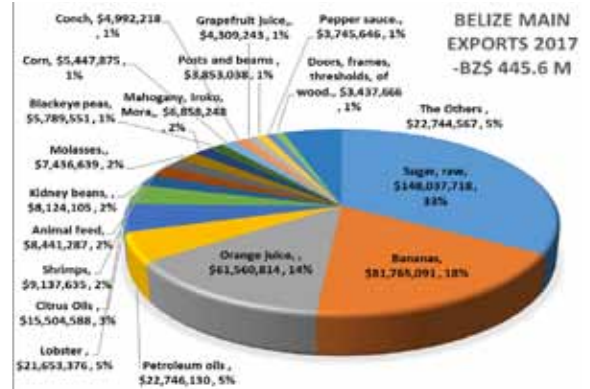
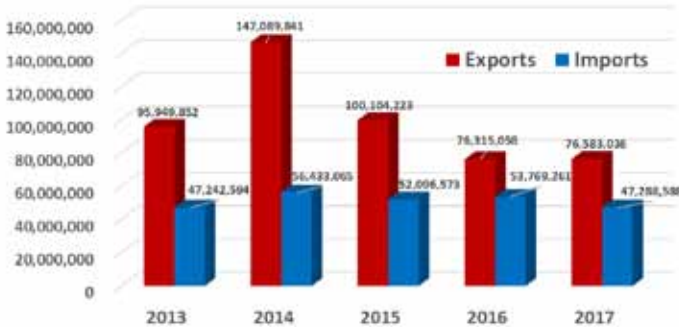
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BELIZE EXPORTS BY REGIONS 2017



BELIZE - CARICOM TRADE (2013-17)

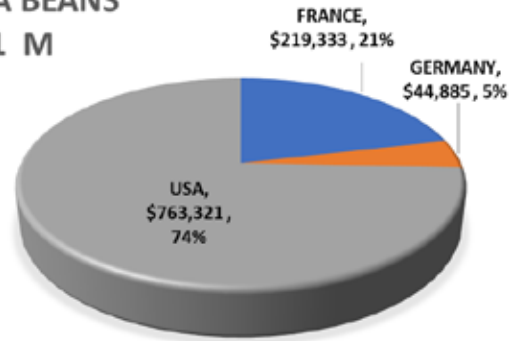


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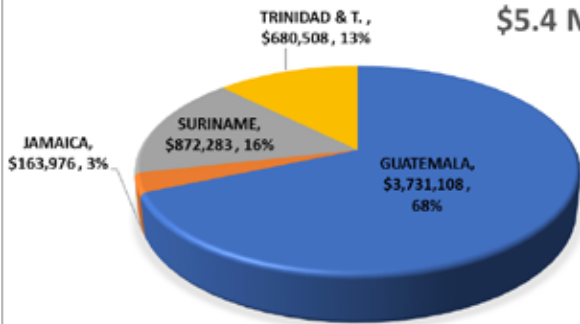
CORN MEAL
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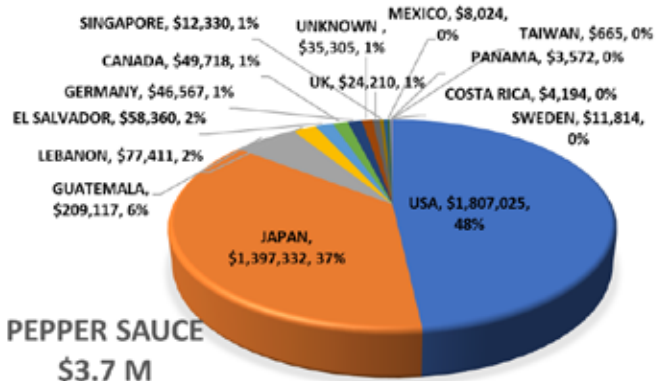
COCOA BEANS
\$1 M



CORN
\$5.4 M

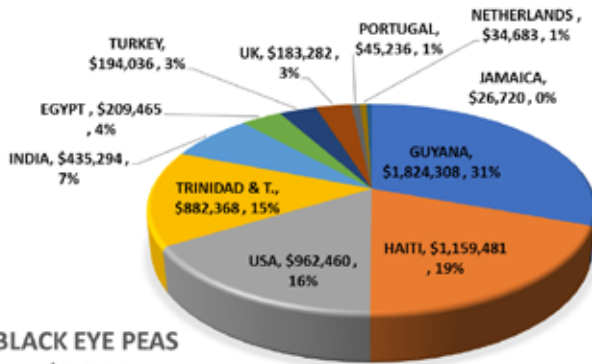


PEPPER SAUCE
\$3.7 M



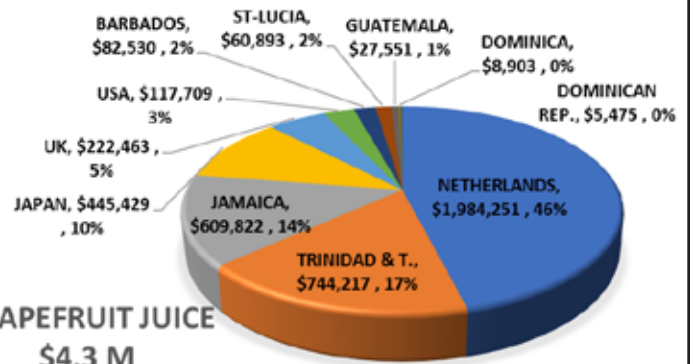
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BLACK EYE PEAS
\$5.9 M



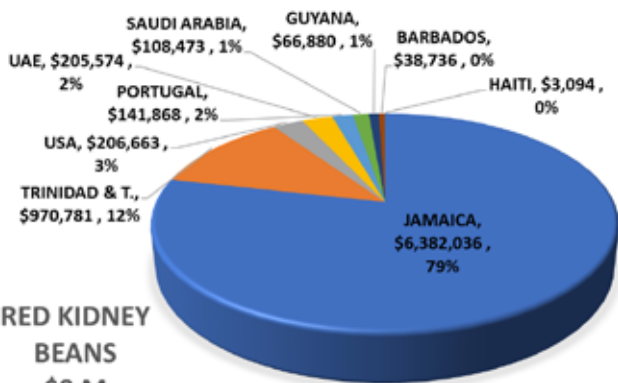
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GRAPEFRUIT JUICE
\$4.3 M



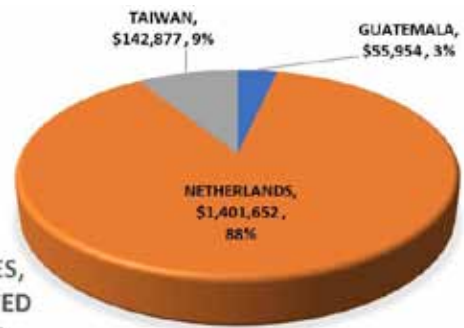
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RED KIDNEY BEANS
\$8 M



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ORANGES, PRESERVED
\$1.6 M



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BEYOND THE BACKYARD

Arrowroot, the Obedience Plant

By Jenny Wildman



My criteria for choosing plants for my garden are usually 1. Can you eat it? 2. Is it attractive or showy? No doubt this is why the arrowroot plant did not cross my gate until now. I was well acquainted with British biscuits and infant teething rusks and have long used the white powder as a thickening agent as opposed to corn flour. Yet I had never seen a plant or had any idea of its uses and its impressive history. When I began to

hear stories about *Maranta arundinacea* especially since it is native to Mexico and Central America it was indeed time to research. Its first use was as a poultice for extracting poison from wounds inflicted by enemy spears and arrows, spiders, scorpions and mosquitoes. It was gathered from its rain forest habitat for animal feed. As a fast growing perennial high in fiber, its usefulness was seen and it became one of the earliest domesticated plants. (8200 BCE)



The term arrowroot is sometimes used for starch derived from other rhizomes such as cassava and kudzu but it is the *Maranta* that carries the title for commercial production. The scientific name was after the 16th century Italian physician Bartolomeo Matanto who, no doubt, was interested in ethno-medicinal usage for digestion, urinary tract and bowel complaints. It boosts the immune system and fights inflammation. It was grown as a staple by the Caribbean Arawaks who called it aru aru, the meal of meals. This and the origin of the name *obedience plant* may elude us but the details of usage are readily available and much of this knowledge comes from the Taino Indians.

English households were introduced to arrowroot as early as 1730 often becoming baby's first food and even used as a milk substitute. The largest producers are St. Vincent and

the Grenadines although demand has lessened with the introduction of other starch substitutes. As a thickener it congeals at lower temperatures and is somewhat gelatinous so good for fruits and puddings. Two teaspoons of arrowroot mixed into cold liquid first, equal one tablespoon of cornstarch. It is a preferred agent for dishes that will be frozen and reheated and when added to ice cream it prevents ice crystals.

Nutritional information differs. Probably mostly carbohydrate, it is said to be also high protein with beneficial minerals. The tubers contain 23 percent starch and can be eaten raw, steamed, or roasted and are excellent in stir fry as an alternative to the water chestnut, requiring only light cooking. Also recommended as a gluten-free alternative. Chicken stock and arrowroot flour make delicious crackers. It can be used safely in children's craft projects. It is a bit like wallpaper paste but edible.

There is demand for arrowroot as a vegetable in Chinese cooking but harvest time is crucial as the tubers go very hairy with age and become inedible. Today it is mainly purchased as a thickener and is used in production of candies, cosmetics such as bath bombs and body powder, also some types of glue. The starch was used in the paper industry during the 19th century, excellent for reproduction of antique papers and was the key ingredient for the first carbonless paper. In the same century it was included as medicinal powder for the Antarctic expeditions.

The *Maranta* is related to ginger and is also grown as an ornamental, the variegated making a very attractive houseplant in Florida. It tolerates most environments although naturally its best is a warm wet tropical climate and requires good water supply. Within 90 days it begins to flourish but takes 10 months before ready to harvest the tubers when the foliage starts to wilt. The papery outer skin is removed, the tuber is thoroughly washed, grated and pulped by adding to water where the white starch is extracted, then put in the sun to dry. The resulting white powder is the arrowroot as we know it. The bi-product or bitte (the trash) can be used for chicken or pig feed.

I was attracted initially by its names and as a revered plant it deserves further attention.

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Travel Global, Eat Local By Alexia Peralta



MINISTRY OF TOURISM
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The Ministry of Tourism and Civil Aviation (MTCA) in collaboration with the Ministry of Agriculture launched the **Tourism Consumption Study** at the 54th Annual Caribbean Food Crop Society (CFCS) Meeting held in Belize City in July 2018. The aims of the study are to quantify the existing and potential demand of agricultural products by the tourism industry as well as to assess barriers that inhibit the linkage between agricultural supply and tourism demand and ultimately determine possible interventions to improve the supply of local agricultural products to the tourism industry.

With an average annual increase of 7.36% in tourism arrivals¹, there has been a corresponding increase in food consumption in the tourism sector. During their visits, tourists generate both direct and indirect demand for agricultural goods and services. With an agricultural- and tourism - based economy, Belize has an opportunity to link the agricultural supply of 7,496 local farmers² to the 427,109 overnight tourism³ sector's demand. However, to meet the demands of the tourism industry the local farmers require market information of the hotels' and restaurants' demand, preference, and need in order to supply the local tourism market. The lack of market information limits their ability to adequately supply to a domestic export market and capture economic opportunities.



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In most cases, this has translated into an increase in importation in order to meet the ever-growing demand of the tourism market. This increase in tourism and food consumption has led to an increase concern about the leakage of earnings due to the estimated average annual increase of 3.34% in imports to satisfy demand. In an effort to quantify and to develop necessary interventions, the MTCA has developed an online web data application that enables the estimation of the demand of Belize's 13 primary commodities which are locally grown, but also imported. By determining the demand and preference of the tourism industry, the study will complement the findings of the National Agriculture Census and enable the Ministry of Agriculture, to adequately direct agricultural production in Belize.

The first pilot survey using the online system was conducted in August 2018 in San Pedro Town, Ambergris Caye, the country's number one tourism destination. The island represents the highest concentration of accommodations and is 25.5%⁴ of the national room stock and boasts the highest level of visits per destination (181,443⁵ tourists), and 44.8%⁶ occupancy rate. Overall visitor population exceeds local population annually on the island by 8 times. Due to the coral lime stone structure of the island, agricultural development, is inhibited and most commodities utilized on the island are transported on boat from adjacent communities such as Maskall, Bomba & Nago Bank, all located in one of the top productive agricultural zones for the country (Belize City).

The results of the study will allow the correlation between agricultural production, tourism consumption and importation data. Preliminary results show that the top five highest demanded commodities are limes, onions, potatoes, tomatoes and cauliflower. Interestingly, the top two imported commodities in 2017 were onions and potatoes costing the country over \$2.5 million BZD⁷. According to 2017 agricultural production data, lime production in Belize is insufficient to meet the weekly demands of the tourism industry in San Pedro. Overall, these products are primarily demanded on a weekly to bi-weekly basis. The tourism stakeholders were keen to note that their main concerns in purchasing agricultural products are quality, consistency, cleanliness and availability of the products upon purchasing. The importance of standards and product quality cannot be overstated. It is a matter of fact, that the quality of the product is the number one factor driving the purchasing of products by the industry. The program will continue for an entire year to ensure the capture of seasonality and annual trends given that the period would include consumption data from both the high and low seasons of tourism.

The study will improve overall market intelligence for local farmers and the Ministry of Agriculture while enabling the tourism industry to source quality agricultural products. Enhancing tourism and agriculture linkages represents an important potential mechanism for stimulating local production, retaining tourism earnings in the country, and improving the distribution of tourism benefits to rural communities. Converting farmers and rural inhabitants into economic stakeholders and beneficiaries of tourism represents an important opportunity for overall economic development.

¹³⁴⁵⁶ Belize Tourism Board Tourism Digest 2017

² Ministry of Agriculture

⁷ Statistical Institute of Belize Merchandise Databases

Spanish Lookout's Quality Feed Mill Expands Soy Processing as Local Soy Production Replaces Imported By Roberson/Feucht



After becoming convinced that Spanish Lookout farmers could grow soybeans well and that their community would benefit from a soy processing facility, Quality Feed Mill (QFM) cautiously worked to accomplish that goal, purchasing their first soybeans in 2013. At that time all their beans were processed at a facility in Blue Creek, Orange Walk District. In 2013 they purchased and moved various pieces of soybean processing equipment from Yo Creek, Orange Walk, where a soybean processing facility had been built but was never fully operational. In 2016 the first soybeans were processed at their Spanish Lookout facility. Also in 2016, a visit to QFM by tourist Joel Yorgey of Iowa led to interactions positive to both. Joel owns and manages Northern Iowa Grain Processors LLC (NIGP) in Riceville, Iowa. NIGP operates 4 sets of equipment similar to that of QFM. A conversation began about soy processing that resulted in a group from QFM visiting Joel's operation in January of 2017. QFM decided to take advantage of Joel's experience and a consultancy with him advising QFM on soy processing was started.

Belize has been purchasing US soybean meal for several decades and continues to do so but with decreasing quantities. Soybean meal is used in most commercial chicken and pig feeds as hybrid corn's protein of approximately 7.5-8% needs to be supplemented by adding soybean meal of approximately 46% protein.

The imported soybean meal, grown either in South or North America then processed in the Mexico's Yucatan, is trucked to Belize. QFM realized that to grow and process the soybeans in country would result in a huge foreign currency savings and healthier and more nutritious products. The Yucatan soybean mills use the solvent hexane to expel the oil, always leaving a small contamination of the solvent in the soybean meal. Joel's Iowa operation uses mechanical expellers (no solvent), and that is what he advised QFM to use.

In 2016 QFM had built 2 soybean storage bins, having a combined capacity for 110,000 bags, or 11 M lbs.

In one 12 hour day, typically 30 tons of soybeans are processed, yielding at the end, 24 tons of soybean meal with the oil and



moisture removed and about 1,200 gallons of de-gummed soybean oil. The beans which QFM purchases have been either dried on the farmer's premises or sent to a professional drying facility such as Central Grain in Spanish Lookout. Even if the beans were harvested at an optimum moisture content of 10%, they need to undergo typically a 60-90 day 'sweat' during which the beans become 'stabilized', meaning that the moisture within the beans is equalized. Here's the basic process:

Step 1. The Pre-Cleaner: Before being loaded into the storage bins, the pre-cleaner removes leaves, weeds and all foreign material such as rocks, small stones, etc. which would damage the equipment. It takes about 10 minutes for approximately 580 bu. (35,000 lbs.) of beans. After being cleaned, the beans begin their 'sweat' in the storage bins.

Step 2. The Rotary Screener: This provides further cleaning. Then the beans enter a holding bin.

Step 3: The Small Roller Mill: Approximately 50 bags of beans per hour can be processed out of the raw holding bins (tanks) into the small roller mill, where the beans are typically broken into 6-8 pieces.



The extruder

Step 4. The Extruder: Working as a continuous pressure-cooker powered by a 300 hp electric motor, the extruder rapidly raises the temperature of the soybeans to 280-300 degrees F. This causes the beans to lose about 3% moisture, and more importantly, the levels of trypsin and urease are decreased, and the oil within the beans' cells is released to the beans' surface. The extruder's flash cooking renders the soymeal digestible to single-stomached animals. Only ruminants can safely consume un-extruded soy.



The expeller

Step 5. The Expeller: In another quick process, the expeller squeezes the oil out of the approximately 280 degree crushed beans in about 30 seconds solely by mechanical pressure. The soybean cake exits the expeller in a continuous flow, as the oil drains into a settling tank. In one hour approximately 750-850 lbs. of oil are expelled and about 3850 pounds of soybean meal remain of the input of 5,000 lbs. of crushed beans from the extruder.

Step 6. The Cooler: Soybean meal is fed into the cooler continuously. There, cool air is sucked through the cake until the cooled cake is ready for automatic discharge into the hopper.

Step 7. The De-Gumming Process: The gum is removed from the oil, via a slow settling of the solids. It would be possible to speed this up using a centrifuge, but that is not required at this time at QFM. About 120-150 lbs. of gum are produced out of 24 tons of meal processed daily. In other countries, with more advanced processing, the gums are a small but valuable part of the beans. All label-reading consumers have seen lecithin, Vitamin E and riboflavin as added ingredients to processed foods. If the gums are dried, these valuable additives and lubricants can be separated out and marketed. As Belize has no processing equipment to dry and separate the gums, these are simply added back into the soybean meal, increasing its nutritional profile. It also increases the digestibility of the soy to livestock. The Mexican meal used in QFM's feeds is about 80% digestible, whereas QFM's meal is about 85-90% digestible – creating a boon for Belizean feed purchasers.



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What does QFM do with all that soybean oil? About 99% of their de-gummed oil is used at Spanish Lookout's power plant. Six thousand gallons (46,000 lbs.) are delivered to the power plant every other week, where it is burned in an approximate 50-50 ratio with crude petroleum. In the future, QFM is investigating production of vegetable oil for human consumption. Most

vegetable cooking oils imported into Belize are solvent-processed, leaving potentially harmful hexane residues. Thus a locally produced soy oil would be healthier in that respect. QFM will consider the approximate \$4M BzD investment for vegetable oil production in the future, which would put a dent in the Directorate General of Foreign Trade's (DGFT) current estimate of \$31M BzD spent on imported fats. (2017 import figure includes oils, butter, lard and margarine.)

In 2017, QFM contracted approximately 7,000 acres of soybeans. The figure for 2018 was 8,500 acres; QFM processes about 75-80% of that, with most consumed in Spanish Lookout. Farmers' prices for the soybeans are based on import prices. As the local soy is more nutrient dense, slightly less soy and more corn is used in feed mixes, allowing QFM to pay more to the farmer for local soy than the cost of imported. Currently most of the local soy goes into broiler feed but this could change as feed formulas are developed for layers and pigs. QFM has the capacity for twice its current production: a bright future!

Editor's Note: Please refer to our March 2018 issue #39, page 7 <http://agreport.bz/2018/03/spanish-lookout-community-statistics-2017/> to see the tremendous growth of soybean production in western Belize. In 2015 only a meager 215 acres of soybeans were grown in Spanish Lookout.

Cover photo: Consultant Joel Yorgey, manager Daniel Braun and assistant manager Levi Braun. Mill photos by QFM.



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Key Stages of Resilience for Plant Health

By John Kempf

Helping growers make more money with regenerative agriculture since 2006

Reprinted from  November 2011



Our vision and our mission is to help farmers produce healthy crops which are insect and disease resistant and have no need for toxic insecticides and fungicides. We can accomplish this goal by providing farmers with knowledge of how diseases and insect pests interact with growing plants, tools to monitor crop health in the field, and information and materials which can be used to increase and enhance plant health.

The degree of plant health and immunity is based on a plant's ability to form structurally complete compounds such as carbohydrates and proteins. Complete carbohydrates, proteins, and lipids are formed by healthy plants with a fully functional enzyme system, which is dependent on trace mineral enzyme cofactors.

So-called plant pathogens, bacterial and fungal diseases, and insect pests have less complex digestive systems than higher animals and lack the needed enzymes to digest complete plant compounds. In his book titled *Healthy Crops: A New Agricultural Revolution*, Francis Chaboussou has documented a fair amount of research on plant-pathogen relationships, protein formation in plants, and the plant immunity connection. Chaboussou's theory of plant health which he calls "Trophobiosis" is founded on the premise that insect and disease pests cannot utilize complete proteins and carbohydrates as a food source.

We work with a broad variety of fruit and vegetable and broadacre crops in many regions with different soils and different climates. On many of the farms we work with we have noticed some interesting transitional stages of plant health and energy levels as soil and plant health improve over time, frequently over a period of a few months to several years, depending on the crop and previous soil conditions. These stages of improving plant health have been based on our own experiences and in-field observations. Over time and experience on many farms a successful pattern of plant health stages is becoming clearer.

Efficient photosynthesis and the formation of complete carbohydrates is the foundation of plant health and immunity. Without efficient photosynthesis plants will not achieve any level of immunity or performance.

With functional photosynthesis and adequate levels of minerals and trace minerals to serve as enzyme cofactors, formation of complete proteins is initiated. As photosynthetic capacity and plant energy increase, plants begin to store surplus energy in lipids, plant oils. These lipids are the building blocks used to build plant protection compounds, called plant secondary metabolites (PSMs) or plant essential oils.

Plant Health: Phase 1

In this foundational phase of plant growth and health, a plant's needs for adequate sunlight, air, water and minerals are all being met, an efficient photosynthetic process is absorbing carbon dioxide from the air, water from the soil, and with the energy input from the sun, begins producing plant sugars, carbohydrates.

Initially the sugars formed during this process will be monosacharrides; simple sugars such as fructose, sucrose, and dextrose. As the process evolves more complex sugars called polysaccharides begin to develop. Cellulose, lignin, pectins, and starches are structural and storage carbohydrates produced in greater quantities as plants become healthier.

In our experience, as long as plants are photosynthesizing properly and producing pectins and other complex carbohydrates, these plants do not seem to be susceptible to soilborne fungi — known as "pathogens." Saprophytic fungi (fungi which decompose dead plant residue) such as *alternaria*, *fusarium* and *verticillium* only become a problem when plants are unhealthy to the point where they no longer develop complete carbohydrates. As long as we have active photosynthesis and energy transfer these "pathogens" cease to be a problem.

Phase 2

As photosynthetic energy increases, plants begin to transfer greater quantities of sugars to the root system and to the microbial community in the rhizosphere. This increase in energy and a food source for the soil microbes will stimulate them to mineralize and release minerals and trace minerals from the soil matrix and provide them in a plant-available form. Plants then utilize these essential minerals as enzyme cofactors which are needed to form complete carbohydrates and especially proteins. Soluble sugars — monosacharrides — when partnered with nitrogen are the base materials used to form amino acids.

Through the action of enzyme catalysts these amino acids are bonded together to form peptides, from which complete proteins are formed.

Thanks to their rapid metabolism, insects need large amounts of protein for growth and reproduction. They can source their protein requirements from plants, which have elevated levels of soluble amino acids in the plant sap. Many insects have a simple

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digestive system which lacks the digestive enzymes needed to digest complex proteins. In our experience, plants which are forming complete proteins and have low levels of soluble amino acids are not susceptible to insects with simple digestive systems. This would include insects such as aphids and whiteflies, and especially larval insects such as cabbage loopers, corn earworm, alfalfa weevil, tomato hornworm and many others.

Phase 3

As photosynthetic energy and efficiency increase plants develop a surplus of energy beyond that needed for basic growth and reproduction. Initially, large quantities of this surplus energy in the form of sugars is translocated to the root system, as high as 70 percent of the total sugar production. Later the plant begins to store this surplus energy in the form of lipids (plant fats) in both vegetative and reproductive tissue. In vegetative tissue these fats are primarily in the form of Omega 3s, whereas Omega 6s and 9s are mostly found in the storage organs of the fruit.

Plants always maintain a minimum baseline of lipid levels since they need these compounds to help form the phospholipid cell membrane. As energy and lipid levels increase this cell membrane becomes much stronger and more resilient enabling it to better resist fungal pathogens. It appears as though once plants achieve higher lipid levels and stronger cell membranes they become more resistant to the airborne fungal pathogens such as downy and powdery mildew, late blight, scab, rust, and others as well as some bacterial invaders, notably fireblight, bacterial speck and bacterial spot, among others.

It should be noted that plants must have a functional digestive system (the microbial community in the rhizosphere) before they will develop to this stage of plant health, otherwise they will lack the energy needed to develop higher levels of lipids.

Phase 4

The elevated lipid levels developed in phase III are then used to build complex plant protectant compounds. The plant builds these PSMs, or essential oils, to protect itself from would-be parasites, UV radiation, or overgrazing by insects or herbivores. Many of these compounds, which include terpenoids, bioflavonoids, carotenoids, tannins, and many others, contain anti-fungal and anti-bacterial properties, as well as digestion (enzyme) inhibitors.

Once plants achieve this level of performance, they become immune to insect attack from insects possessing a better-developed digestive system, primarily members of the beetle family such as cucumber beetles, Colorado potato beetles, and Japanese beetles. At this point, plants have a tremendous level of stress tolerance and can cope with weather extremes reasonably well.

Again these phases of plant health are based on our observations and experiences in the field. Transitions in the field are not always clearly delineated as in the chart, however over time a clearer picture begins to emerge as crops and soils become healthier and healthier and "pathogens" become less and less of a problem.

John Kempf is the owner of Advancing Eco Agriculture (800-495-6603) in Middlefield, Ohio, an eco-agriculture consulting and solutions company.
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The Belize Agriculture Information Management System (BAIMS) and the 2018 Belize National Agriculture Census

By Milagro Matus

The agriculture and food sector is one of the main pillars of the Belizean economy, contributing approximately \$590 million annually to economic output, representing 80% of domestic exports, and directly employing 17.9% of the Belizean population. Moreover, it is a major foreign exchange earner, maintains a vibrant rural population and ensures food and nutrition security for the country.



The Ministry of Agriculture is implementing initiatives to reform the enabling environment for agriculture and food production including the regulatory framework, market reform, and adoption of advanced technologies to counter the significant challenges posed by climate change. The BAIMS, a web-based application that serves as a central repository for data collection and dissemination, was developed by a local company, KYN Consulting of Corozal Town.

The BAIMS evolved from an in-depth country assessment on agriculture statistics, and the Strategic Plan for Agriculture and Rural Statistics (SPARS) following the standards set by the Food and Agriculture Organization (FAO). This project was funded by the Inter-American Development Bank and the Ministry of Agriculture. The BAIMS is now being populated via the National Agriculture Census 2018 with key information on the farmer, geo-referenced coordinates of farms and details on the farming activities.

Accurate, timely & reliable information is critical for objective analysis of the agriculture sector's contribution to the socio-economic development of Belize and evidence-based decision making by the ministry. With this functioning system we will be able to generate the following:

1. A farmer registry
2. A geo-referenced farm registry
3. Production projections from pre-planting to expected harvest to ensure that there is a supply and demand balance (to avoid scarcity or oversupply)
4. Production trends and economic outlook

The data will also support farmers, buyers, agro-stakeholders & government users to:

1. Create better opportunities for linking products to local, regional or international markets
2. Advocate for the development of better financial policies for greater and more affordable agriculture credit
3. Better allocate resources and focus programs, grants and projects to address the needs of the farming communities.

With the geo-referencing data from the BAIMS Farm Registry, the Ministry of Agriculture can now take advantage of new technologies available through geographic information systems to do analysis and deliver better services to the farming community. The ministry is using the Farm GIS data for 4 specific reasons:

1. To assist with the surveillance and management of pest & diseases
2. To assess damages and recovery needs in times of natural disaster (flood, drought etc.)
3. To provide support and technical advice in water management and climate change mitigation
4. To monitor and measure land use changes.

The National Agriculture Census (NAC) - The NAC is a count of all the farmers and farm activities in Belize; it will present a true picture of the state of agriculture in the country on who the producers are and what and how much is being produced. The NAC will be used to do the first count of farmers; the ministry will continue to collect data to keep the BAIMS updated.

NAC data will be collected through interviews by ministry personnel and 20 authorized enumerators, bearing a ministry identification card and wearing an NAC 2018 T-shirt. Before census personnel begin the census in a village, sensitization and awareness will take place at the village level through local radio stations, village leaders, chairpersons, church pastors and schools. Upon reaching each farmer, personnel will introduce themselves, explain the purpose of their visit and the confidentiality of the data being collected. Census personnel will use a tablet to collect data. In addition, during the interview, enumerators will request from the farmer permission to take a picture of them or of a farmer identification card and request a visit to the farm to obtain the geo-reference location.

The NAC, having begun in the district of Cayo on August 6, 2018, will end on June 14, 2019 in the district of Toledo. *While ministry personnel will be conducting interviews village by village during this time, farmers are encouraged to visit an agriculture office and be counted. Farmer and farm registration is open year-round.*

2018-2019			
District	Period		Deadline for application
Cayo	6 th Aug.	20 th Sept.	24 th July 2018
Belize	24 th Sept.	9 th Nov.	27 th August 2018
Orange Walk	12 th Nov.	20 th Dec.	12 th October 2018
Christmas Holidays			
Corozal	7 th Jan.	22 nd Feb.	14 th December 2018
Stann Creek	25 th Feb.	12 th Apr.	25 th January 2019
Easter Holidays			
Toledo	29 th Apr.	14 th Jun.	28 th March 2019

Table 1: Table showing the months when the Census will be implemented in each district

Following the census, data collection, in the form of production surveys, will be a recurring activity to update the data management system and form the basis for a virtual marketing platform linking farmers directly to markets.

Why should farmers participate? If you are a farmer your benefits for participating include the following:

- You will be provided with an official Farmer Identification Card recognizing you as a farmer.
- With accurate production data, the ministry can better link your produce to available markets.
- By knowing where you are and what you produce, the ministry can better respond to your needs in times of disaster recovery, pest and disease outbreak, or any other assistance required.

What will be done with collected information?

- All individual data collected will remain *secure and strictly confidential*.
- *Only aggregated data will be provided in official publication.*
- The data will assist in identifying targeted areas where support can be provided.
- The results will support government in measuring the impact of support to agriculture.
- The contribution of the agriculture sector and its industries will be accurately measured and reported.
- The data will guide the ministry in conducting continuous agriculture production surveys for priority commodities to advise farmers and decision makers on the projections of production from pre-planting to pre-harvest.

Complementary Programs: Other activities that the ministry is implementing to supplement the BAIMS are listed below:

Market Prices Application - In addition to the BAIMS, online application, a mobile application (both Android and Apple)

is available displaying weekly retail market prices of selected agriculture products at traditional markets. The information will assist in setting the fair price of agriculture commodities at the market, ensuring that farmers are aware of current average prices throughout the country of Belize.

Virtual Marketing Platform - Coming soon is a parallel but independent system to BAIMS, a Virtual Market Platform. The objective of the application is to directly link farmers to buyers so that they can share contact and production information, similar to the popular "CRAIGS list" for agriculture commodities. This voluntary component will require farmers to register first to BAIMS and obtain a farmer ID number to register to the virtual market platform. The benefits of the platform are numerous, increasing sales and farmers' real income by allowing access to real time agriculture produce at the touch of a button and providing farmers with a direct market for their products; trade is also national in scope.

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Agriculture Prices at a Glance- \$\$\$\$\$\$ OCTOBER 2018

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	S/S/H	Czl	1.90	OW	1.90	Bze 1.85
750-1100 lbs	H/S/L	Cy	1.90	SCR	N/A	Tol 1.90
Weaner steers	S/S/S	Czl	1.50	OW	1.50	Bze N/A
"	L/S/S	Cy	1.65	SCR	N/A	Tol 1.50-1.85
Breeding heifers	L/S/L	Czl	1.45	OW	1.60	Bze 1.50
"	L/S/L	Cy	1.60	SCR	N/A	Tol 1.40-1.60
Cull cows	S/S/S	Czl	1.10-1.50	OW	1.30	Bze 1.05-1.30
"	H/S/S	Cy	1.50	SCR	N/A	Tol 1.25
U.S. CATTLE						
U.S. price - corn fed - 1000-1200 lbs	H	US\$ 1.13800				
U.S. price - feeders 600-800 lbs	H	US\$ 1.57425				
BELIZE HOGS						
Weaner pigs - 25-30 lbs - by the head	S	100.00				
Butcher pigs 160 - 230 lbs, per lb	H	1.85				
Butcher pigs 160 - 230 lbs, per lb	H	1.70				
BELIZE SHEEP						
Butcher lambs - live per lb *	S	2.50				
Mature ewes - live per lb	S	2.00				
Mature ewes - live per lb	S	1.75				
BELIZE CHICKEN						
Wholesale dressed, per lb (Sp Lkt)	S	2.32				
Wholesale dressed, per lb (Bl Crk)	S	2.36				
Broilers - live per lb (Sp Lkt)	S	1.13				
Broilers - live per lb (Bl Crk)	S	1.18				
Spent hens per 4 lb bird (Sp Lkt)	L	2.00 rising soon				
Spent hens per 4 lb bird (Bl Crk)	S	3.50				
CITRUS						
Oranges per lb solid, est. final	S	2.2382 (\$13.2051 per box)				
Grapefruit per lb solid, est. final	S	3.0620 (\$11.9419 per box)				
COCONUTS						
Green Coconuts, del'd to Cayo, bulk	S	sm 0.40 med 0.45 lg 0.50				
Dry Coconuts, del'd to Cayo, bulk	S	0.35 - 0.40				

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

GRAINS, BEANS & RICE						
	T	A	B	C		
Belize yellow corn, bulk (Spanish Lookout)	-	0.225 - 0.23				
Belize yellow corn, bulk (Blue Creek)	S	N/A	0.27 (feed)	N/A		
Yellow corn/local retail (low volume, Sp Lkt)	L	0.225 - 0.23				
Belize white corn, bulk (Spanish Lookout)	-	0.225 - 0.23				
US Corn, #2 yellow	L	US\$3.8475 / 56 lb bushel				
US organic, #2 yellow corn feed grade	H	US\$9.00-12.65 / bushel				
Belize soy beans (Spanish Lookout)	H/L	0.4650 set price	0.4032 floating price			
Belize soy beans (Blue Creek)	L	0.45 cash / 0.4950 payments				
US soy beans, #2 yellow	L	US\$8.235 / 60 lb bushel				
US organic, #1 feed grade soy	S	US\$18.00-20.90 (futures)				
Belize milo (Spanish Lookout)	S	N/A				
Belize milo (Blue Creek)	S	N/A				
Red kidney beans (Spanish Lookout)	L	0.90				
Red kidney beans (Blue Creek)	S	N/A				
Black eyed peas (Spanish Lookout)	L	0.55				
Black eyed peas (Blue Creek)	S	0.65				
Paddy rice per pound (Spanish Lookout)	S	0.38-51 farm price, dried				
Paddy rice per pound (Blue Creek)	L	0.35-0.40 farm price, dried				
SUGAR/HONEY						
Sugar cane, ton, estimate ONLY	S	\$42.51				
Bagasse, per ton - payment, not estimate	S	\$0.50 (price still undetermined)				
Honey, 5 gal (approx 60 lbs)	S	\$210.00 (CQHPC)				
Honey, specialty, 5 gal (approx 60 lbs)	S	\$210.00-250.00 (Cayo)				
SPECIAL FARM ITEMS						
Eggs - tray of 30, farm price	H	4.88 (Sp Lkt)	5.85 (Blue Creek)			
WD milk/lb farmer base price (varies by fat%)	L	approx 0.49 contract approx 0.39 non-contract				
Raw milk (farmer direct sales)	S	6.00 per half gal				
CACAO						
Cacao beans Organic (MMC) /lb	S	3.50 dried fermented				
Cacao beans Organic (MMC) /lb	S	1.10 wet beans				
US Cacao beans, metric ton (ICCO)	L	US\$ 2,176.97				

Management of Internal Parasites of Sheep and Goats

By Daniel Juan



Belize is in the process of building a sheep meat industry and is also experiencing a relatively new expansion in goat production, particularly focused on dairy. With this new direction it is important to improve various aspects of their production. These include genetics, nutrition, reproduction, husbandry, health and marketing. A number of these are being addressed by various entities.

This article hopes to shed some light on one aspect of health – internal parasite management. Internal parasites of these livestock are generally pulmonary or gastrointestinal. Animal related factors influencing infestation level include breed, age, gestation stage, nutrition and immunity of the individual. Environmental factors include soil moisture and relative humidity among others. Husbandry practices include grazing intensity, grazing system, genetic selection and use of anthelmintics among others.

A predominant internal parasite in warm tropical environments is *Haemonchus contortus* commonly known as wire worm, stomach worm or barber pole worm. The name barber pole is derived from the female's red bands resembling a barber's pole. The red bands are visible to the naked eye when the parasite is engorged.

H. contortus is a blood-sucking nematode without intermediate hosts and can affect sheep, goats, alpacas, deer, bovines and other livestock species. Human infestations are very rare. It produces a condition known as *haemonchosis*. The life cycle can be briefly described as follows: eggs are shed via faeces and hatch within 4 to 6 days under ideal environmental conditions; larvae feed on faecal bacteria and molt into the L₂ stage. At the L₃ or infective stage larvae migrate out of the faeces and onto herbage if adequate moisture is available. The L₃ migrate up herbage

and are ingested by hosts. These molt into L₄ and finally into adults. Adults lance the abomasal lining and ingest blood. It is reported that each adult is capable of ingesting up to 0.03 ml of blood daily (Emery et al., 2016). However, blood loss to the host can be as great as 0.05 ml daily from ingestion and subsequent wound seepage (Taylor et al., 2016). This volume of blood loss can be fatal to animals within weeks during heavy parasitic loads coupled with stress. Stress may be in the form of nutritional deficiencies, late gestation, lactation, disease, overstocking, poor housing conditions among others.

Sexually mature females mate and lay from 5,000 to 15,000 eggs daily (Emery et al., 2016, Junquera, 2016, Leite-Browning, 2006). Eggs are shed via the faeces and the cycle begins anew. Given the short life cycle and copious eggs shed it is not surprising that many sheep and goats suffer from haemonchosis and may easily die if untreated.

Symptoms of haemonchosis include anemia, edema of the lower jaw (bottle jaw), emaciated coat, poor growth and general underperformance, weakness and accompanying inappetence. Diarrhea is generally not a symptom of this condition. Sheep and goats most susceptible are peri-parturient and lactating ewes and does, lambs and kids stressed from weaning, animals that are overstocked and those that are poorly nourished.

A myriad of approaches to control *H. contortus* have been proposed and tested and many have merit. Following is a general description of some of the husbandry approaches.

1. Grazing system: Given that L₃ migrate up herbage during moist conditions (evening and morning dew) this technique promotes grazing animals once the dew has evaporated from the herbage and L₃ are no longer on the tips of herbage and therefore less likely to be ingested by hosts. This can be effective in reducing infestation but it has limitations. These include a limited grazing or browsing period for sheep and goats during the dry season; with continuous moisture during the wet season its practicality diminishes rapidly.

A second approach within this system is to use pasture rotation. Pasture rotation promotes regrowth, plant diversity and may reduce larval populations due to desiccation under hot conditions. The drawback to this is the prolonged period required to drastically reduce larval populations. It is reported that *H. contortus* may survive in pastures for as long as three months. For practical reasons a pasture cannot be rested for that length of time. Furthermore, tropical grasses tend to become less nutritious and palatable if allowed to mature to that stage. A potential solution to this is to rotate livestock species grazed on the paddock. For example, horses are not considered hosts to *H. contortus* and can therefore be grazed when the nutritional value of the pasture is at its peak and this also avoids re-infesting the pasture with *H. contortus* eggs. Once the cycle has been broken sheep and goats can be reintroduced to the paddock.

2. Grazing intensity: It is well-documented that overstocking and overgrazing increases infestation. As the livestock density increases per given acreage the number of infective larvae increase in that given acreage. Hence the host's ability to select larvae-free pasture is compromised. The general recommendation is to graze five adult sheep or goats per acre. Of course this must be adjusted depending on the size and weight of the animal, plant diversity, ground cover and soil moisture availability. A more accurate way to determine the grazing intensity is to use animal units instead of number of animals per acre.

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3. Genetic selection: Each livestock breed has its distinctive traits. Among these are the breed's resistance to internal parasites such as *H. contortus*. Breeds with reported resistance include Barbados Black Belly, St. Croix and Kathadin. Of course even within breeds there are animals that are more resistant than others. The key to improving flock resistance is selection. As such it is necessary to determine which animals are resistant and select from those while culling the most susceptible. Use of the FAMACHA technique and faecal worm egg counts aid in determining resistant and susceptible animals. Hence a genetic improvement scheme should include selection for internal parasite resistance.
4. Anthelmintic use: There is a limited number of active ingredients approved for treating sheep against internal parasites and even fewer for goats. Furthermore, improper use of available anthelmintics has compounded their efficacy. Improper use includes over and under dosing animals by gauging their weight instead of actually weighing them, dosing the whole flock instead of only those with a predetermined infestation level, improper administration of drug such as intramuscular when it should be subcutaneous and so on.

Sheep and goat farmers therefore have many options for controlling this insidious internal parasite. Each farmer must evaluate his/her prevailing environmental conditions, management system and targeted market before determining best practices for internal parasite management for his/her flock. What is almost certain is that neglecting internal parasite management under our conditions will invariably diminish profitability and competitiveness within these industries.

EMERY, D. L., HUNT, P. W. & LEJAMBRE, L. F. 2016. *Haemonchus contortus*: the then and now, and where to from here? *International journal of parasitology*, 46, 755 - 769.

JUNQUERA, P. 2016. *Haemonchus spp., parasitic roundworms of cattle, sheep and goats. Biology, prevention and control. Haemonchus contortus, Haemonchus placei. Haemonchosis.* [Online]. Available: http://parasitipedia.net/index.php?option=com_content&view=article&id=2634&Itemid=2912 [Accessed 31/01 2017].

LEITE-BROWNING, M. 2006. *Haemonchus contortus (Barber Pole Worm) Infestation in Goats* [Online]. ALABAMA A&M AND AUBURN UNIVERSITIES. Available: <http://www.aces.edu/pubs/docs/U/UNP-0078/UNP-0078.pdf> [Accessed 04/04 2016].

TAYLOR, M. A., COOP, R. L. & WALL, R. L. 2016. *Veterinary parasitology*, Wiley Blackwell.

Editor's Note: Daniel Juan lives on San Lorenzo Farm near Succotz. He has worked with livestock for many years and studied Animal Science in Costa Rica and is completing his Master's in Agriculture (Animal Science) with a focus on sheep and goats. He has implemented dairy goat and meat rabbit projects and has worked with beef and dairy cattle. He is a qualified teacher with many years of experience, currently teaching at Mt Carmel High in Benque Viejo, Cayo District. His hobbies include nature walks and learning about farming.

Photos by Daniel Juan

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BLPA and CATIE Sign Agreement for Technical Assistance



On Wednesday 15th August 2018, Ms. Elba Cruz, Manager of the Belize Livestock Producers Association (BLPA) and Dr. Muhammad Ibrahim, Director of The Agronomic Centre for Tropical Research and Education (CATIE) signed an agreement for

the provision of technical cooperation services to strengthen the livestock industry. This agreement is part of a project "Improving Livestock Sector Productivity and Climate Resilience in Belize - ATN/ME-16402-BL T1094" funded by Multi-Lateral Investment Fund (MIF) of the Inter-American Development Bank Group (IDB) and executed by the BLPA. The project's goal is to contribute to reduce vulnerability to climate change of small and medium size cattle farmers in Belize. Its objective is to foster the adoption of climate resilient practices and green financial products to increase livestock production in Belize. The BLPA and its project execution team will address these challenges by testing and validating climate resilience practices on 10 "model" farms in the Cayo, Orange Walk and Belize Districts, to serve as examples for other farmers and train at least 250 farmers in smart livestock production.

In collaboration with participating farmers, the project will facilitate comprehensive farm audits that will inform the development of climate resilient farm improvement plans, customized to specific on-farm needs. The project will also enhance the capacity of livestock extension services (within BLPA and the Ministry of Agriculture) to support farmers with implementation. Extension services will also contribute to augmented data collection and analysis (including national annual surveys) facilitated by a mobile application, developed and currently being tested by BLPA. Complementary green finance will be developed and piloted by La Inmaculada Credit Union (LICU), extending credit to farmers so that they can invest in new measures/technologies.

The project is scheduled to conclude in April of 2021.

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Wednesday 14th & Thursday 15th: 8:30 - 5:00. Different topics presented simultaneously at separate venues.



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- * Regenerative Citrus Management, including HLB
- * Marketing Challenges for Non-traditional Crops
- * Integrating Livestock & Silvopastoral Systems
- * Repairing Degraded Land with AgroForestry
- * BioFertilizers: Large & Small-scale Success
- * Regenerative Poultry Management
- * AgroForestry Food Production
- * Turmeric & Vanilla Production
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25 September 2018
PRESS RELEASE

Regeneration Belize Announces A Tropical Agriculture Conference

Regeneration Belize and Regeneration International invite the farmers of Belize to the conference to be held at the National Agriculture and Trade Show (NATS) grounds, Belmopan, 13th-15th November 2018. This is not a traditional expo-type fair, although major sponsors will have displays and products available. The event is an educational opportunity for all interested farmers to come and hear successful tropical farmers share their experiences with regenerative methods. Come learn how to have healthy plants that produce nutrient-dense food even in times of extreme weather.



Regenerative systems have shown to help growers make more money.

Free Admission

Opening ceremonies will be Tuesday afternoon at 1:30, 13th November at the main NATS stage where several of the international farmers will preview their presentations. On Wednesday 14th November choose from 18 different presentations and panels to be given throughout the day at 4 stages. On Wednesday all presentations will be in English. On Thursday, choose from 19 topics, some of which will be in Spanish. Development Finance Corporation (DFC) will present on their financial assistance programs and will be available for individual consultations throughout the event. See our Facebook page for the schedule of topics to be covered by our 6 invited international farmers and 9 local experts. Topics include: Large-scale Agricultural Challenges (e.g., Tillage & Covercrops); Integrating Livestock & Sylvopastoral Systems; Building Topsoil; BioFertilizers; Greenhouse Management; Citrus Management; Regenerative Poultry Management; Beekeeping; Biochar Basics; Edible Landscaping; Medicinal Gardening; AgroForestry and more!

Food vendors will be at the event on Wednesday and Thursday.

For further information go to

www.regenerationinternational.org/belize-conference-2018,

*Regeneration Belize Facebook page or email
regenerationbelize@gmail.com.*

End Press Release

Regeneration Belize Announces International Speakers for the Transforming Tropical Agriculture Conference

Regeneration International (RI) has generously arranged for 6 international tropical farming experts to come to Belize to share their experiences with Belizean farmers at the TTA Conference.

A short introduction to familiarize attendees with the basic concepts of regenerative agriculture will be given by Mr. Ronnie Cummins to begin both full-day schedules. Ronnie is a steering committee member of RI and is the co-founder of the Organic Consumers Association (OCA) and its Mexican affiliate, Via Organica.

Dr. Alvaro Zapata Cadavid: Integrating Livestock and AgroForestry: Sustainable Livestock and Silvopastoral Systems



Silvopastoral systems (SPS) are a type of agroforestry that allows the intensification of cattle production by integrating trees and shrubs in pastures with animals, an integrated approach to sustainable land use. SPS improve overall productivity and provide additional economic, environmental, and social benefits for livestock farmers compared with grass monocultures.

Dr. Alvaro Zapata Cadavid is a technical expert with Fundacion Centro para la Investigacion en Sistemas Sostenibles de Produccion Agropecuaria (CIPAV – Centre for Research on Sustainable Agriculture). He has been working more than 20 years in Colombia and many other countries with these methods. In addition to being a veterinarian, Dr. Zapata holds a M.Sc. in Renewable Energy and the Environment (University of Reading, England).

Two Presentations by Marcelo Marzola: Tackling Large Scale Regenerative Ag Challenges

In this presentation Marcelo will share his experience with large scale regenerative agriculture systems including challenges, lessons learned and successes with no-till, min-till and cover crop techniques in the tropics.



Regenerative Citrus Management

In this presentation Marcelo will address regenerative citrus management techniques and, specifically, experience with HLB, based on his work with farms, including Fazenda de Toca, in Brazil.

Marcelo Marzola is one of the world leaders in regenerative agriculture, especially regarding applications to large scale operations. He is a co-founder & co-CEO at Rizoma, a regenerative agriculture company near Sao Paulo, Brazil. Rizoma is a regenerative agriculture production company whose aim is to impact millions of hectares of commercial and small-scale agriculture by developing regenerative models that are economically viable and scale-able. They are preparing for the next stage of growth for two pilot farms totaling 1.200 hectares. As CEO at PPD Holding he manages investments in food and agriculture.

Andre Leu: Building Topsoil with Regenerative Practices



Topsoil is where the majority of the plant available nutrients, beneficial microorganisms and crop available water are found. The most important component of topsoil is organic matter composed mostly of soil organic carbon (SOC). It is estimated that agricultural soils have lost 50% to 70% of their original soil organic carbon pool and the depletion is exacerbated by further soil degradation.

Longer rotations, cover crops, green manures, legumes, compost, organic mulches, biochar, perennials, agroforestry, agroecological biodiversity and livestock on pasture using holistic grazing systems are starting to come under the heading of Regenerative Agriculture because they regenerate SOC.

Andre is a founder of RI and serves as their international director. He was the longest serving president of IFOAM – Organics International. Andre has over 45 years' experience in almost every aspect of agriculture; he and his wife have an organic fruit farm in Daintree, Australia.

Reginaldo Haslett-Marroquin: Regenerative Poultry Management

Reginaldo will present on a revolutionary *Poultry Centered Regenerative Farm* model that is a success in Guatemala, Mexico and the US. The model is built not on a nearsighted drive toward maximum profit, but on a *triple* bottom-line being ecological, economical and socially viable. At the system's center are free-range meat/egg poultry, raised in a well-managed paddock planted with a combination of perennials, cover crops, and small grains that provide additional cash value to the farmers and nutrition and shelter for the chicken. In exchange, the chickens provide the manure to fertilize not only the paddock and the plants within, but also other vegetables and perennials for additional agricultural enterprise. With their short life cycle, chickens provide a positive revenue stream at a low cost of entry.



Reginaldo Haslett-Marroquin is a founding member of RI, and is the chief strategy officer in the Main Street Project. Raised in the Guatemalan rainforest, Reginaldo has an agronomy degree from the Central National School of Agriculture in Guatemala and international business and communication degrees from Augsburg College, Minnesota.

Elder Adrian Calderon: Benefits of Ecological Beekeeping

Elder Adrián Calderón Granados is an agronomist and ecological beekeeper from Petén, Guatemala. His presentation will discuss how ecological beekeeping offers a range of benefits to rural families and the natural environment. He will address how beekeeping offers rural families the opportunity to produce a number of products derived from bees and how apiculture can be an excellent source of employment and income in rural areas. He will also share how beekeeping can contribute to restoring degraded landscapes and the health and well-being of forest ecosystems.

VACA AT A TURNING POINT

FRIENDS FOR CONSERVATION AND DEVELOPMENT



The Vaca Forest Reserve (VFR) is the closest forest reserve to the communities of Arenal, Benque Viejo del Carmen and San Jose Succotz. For the young boys of the Youth Environmental Action Group (YEAG) based in Succotz, this reserve was the closest, too, for outdoor camping and nature studies in the late 1980's. At that time Don Antonio Morales used to describe the richness of the forest bustling with wildlife, intact caves and fresh water. But he had concerns since there was much talk about the construction of the dam on the Macal River and road access to the core of the Vaca Plateau. His late night anecdotes would end up with hopes that the forested area would remain just as how he found it in the late 1970's when he arrived in the Vaca Plateau.

The VFR covers an area of 40,303 acres (16,317 ha), and forms part of the Greater Maya Mountains Massif (a key biodiversity conservation area). It is bordered on the east by the Mountain Pine Ridge Forest Reserve and Nojkaaxmeen Elijio Panti National Park and to the south by the Chiquibul National Park.

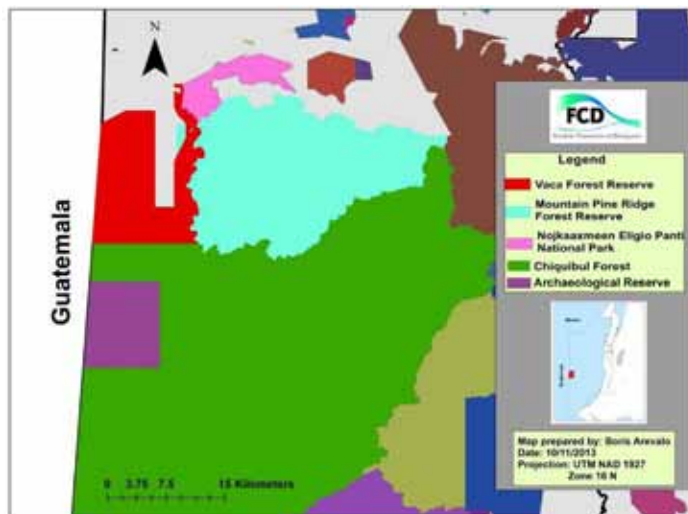


Figure 1: Spatial setting of Vaca Forest Reserve in relation to other protected areas

It was 20 years later that YEAG, now known as the Friends for Conservation and Development (FCD) returned to the Vaca Forest Reserve with a conviction of putting in place a program that would include the human and environmental dimension tagged under a modality of co-existence.

The main stakeholders of this effort, funded by the Global Environmental Facility – Small Grants Programme (GEF SGP), would be the farmers found in the area. The work began in 2010, and by 2014 the Friends of the Vaca Forest Reserve was instituted and a full-fledged agroecology system was promoted. Armed with a landscape management strategy, an innovative integration of human populations in a protected area was being tested with endorsement from the Forest Department.

Since then, the forest has passed through a transition stage from a well-forested area to serious degradation and now recovery.

There are four areas and four identified sectors that have been the root of the decimation of this forest. Along the western border are mostly illegal Guatemalans constantly enlarging their fields for agricultural production and cattle ranching. North of the reserve is the community of Arenal that has also been encroaching the reserve. With no clear demarcation of the reserve, it has been easy for local farmers to operate inside the reserve limits. Then there are the loggers, those with a permit to extract trees and those without a permit, who are annually extracting the timber despite it being known that there are no healthy stocks of timber in the area. And finally, there are farmers operating increasingly into the interior of the reserve, precisely where some 11,600 acres (4696 ha) of the reserve were excised in 2003. Bit by bit over the years these farmers have moved into the reserve and are responsible for removing over 1,005 acres (407 ha) of forest.

With the support of GEF SGP, FCD developed a plan to contain the further degradation of the forest by reducing the amount of land that farmers need. Using agroecology and integrated farming methods, it is now being proved that local farmers can generate their local economy without further destroying the forest reserve. For the period of 2017 to 2018 the FCD together with the GEF SGP facilitated a project entitled, “Community Capacity Building and Climate-Smart Innovative Agro-ecological Practices In the Vaca Forest Reserve Project.” The project culminated with a systematization exercise aimed at meeting the following objectives:

1. Assess the farmers' change in attitude regarding community development and environmental stewardship.
2. Identify best practices in the implementation of agroecological strategies.
3. Evaluate the organizational structures and identify lessons learnt that can be used to guide appropriate governance of the VFR.

Findings

At its core, agroecology is built in part on the premise that the natural environment (ecology) is important and that agricultural activities should be compatible with and take into account the ecology of the area. Based on this premise, most members of the Friends of Vaca Forest Reserve (FVFR) do express and are demonstrating improved knowledge and appreciation for the natural environment in the VFR. However, the farmers do indicate that their primary concern is agro-production for livelihoods.

Lessons Learnt

1. Motivation: Food security versus resource conservation -It is widely recognized that in rural agrarian communities, the primary motivating factors are food and income security, especially if these can be achieved by reducing inputs and increasing productivity in a sustainable way. To this end, while the members of the FVFR are for the most part demonstrating increased environmental stewardship, activities that can hinder the productive chain are not prioritized, despite the fact that these can be detrimental to the environment. For example, farmers acknowledge that disposal of agrochemicals containers could be improved.
2. Sustainable use and learning by doing - Community members, and especially farmers, generally operate from a 'show me' perspective, i.e. benefits of sustainable use and conservation of resources such as soil and water must be demonstrated and not only discussed.
3. Accepting agroecology - For the most part, climate change is a relatively new concept to many farmers; the same can

Carambola, the Star By Deborah Harder

Carambola, *Averrhoa carambola*, is also called starfruit because the cross-section of its fruit is shaped like a 5 pointed star (although in rare instances it may have 6 – 8 points); it is a delightful tree with beautiful foliage and sprays of delicate purple blossoms. It grows well in a variety of soils and bears twice a year – November through January and May through August. The fruit, with its rather firm, translucent flesh, seems to appeal especially to Northerners due to its light, juicy quality, as opposed to other tropical fruits, some of which can seem rather heavy and overly rich to northern tastes. The sour variety, which bears very heavily, has a high content of oxalic acid; it is useful for making vinegar and can also be juiced or canned with enough sugar to sweeten it. The sweet varieties are delicious out of hand or used in many ways without much added sugar needed.



Cultivation: Fwang Tung, a Chinese variety, has become the preferred one for us to propagate, yielding big, mild, sweet fruits in generous amounts. Grafted trees generally bear in one to three years, making them one of the first fruits you may enjoy from your orchard. Fruit can be picked as soon as it starts to turn a little yellow and ripened in the house; they will not increase in sugar content if picked when they are a light shade of green.

Use: Some people eat the fruit while other prefer to trim off the lobes, as they are astringent.

The lobes can also be cut apart and the inner membranes removed; they are a little tougher than the fruit and contain the seeds. Carambola is excellent in any fruit or vegetable salad, and of course, the “stars” are appealing on any plate or to top any dessert. Try chunks in a potato salad, or a salsa of carambola, cilantro, onions, garlic, and peppers.

For canning or other cooked purposes, I don't bother removing the membranes, as they cook soft, and seeds are inconspicuous, and time is precious. Starfruit makes an ideal replacement for apple in any apple dessert, such as the cake recipe below. They are an easy fruit to juice, just cut up very ripe fruits in big chunks; sprinkle with sugar and let stand for ½ hour to several hours. This step will draw out the juice. Squish them up with your hands or pound them with a wooden pounding utensil. Squeeze them through a cloth or strainer. Dilute and sweeten further, if desired. To can carambola, use one tablespoon of sugar per pint and boil them in a water bath for 10 minutes for pints.



Carambola / “Apple” Cake

- | | |
|-------------------------------|--------------------------|
| 1 c. carambola, cut in chunks | |
| 1 c. sugar | |
| ½ c. butter | 2 eggs, partially beaten |
| 2-1/2 c. flour | 1 tsp. soda |
| ½ tsp. salt | 1 c. buttermilk |
| 2 tsp. cinnamon | ½ c. sour milk |
| ½ tsp. allspice | |
| ½ tsp. ginger | |
1. Grease 9” X 13” baking pan with shortening.
 2. Sprinkle about ¼ c. sugar on carambola chunks, set aside.
 3. Mix remaining sugar with butter, salt, and spices, to make crumbs.
 4. Reserve ¼ c. crumbs for topping, adding ¼ c. coconut, nuts, or granola if desired.
 5. To remaining crumbs, add eggs, soda, milk, flour and carambola.
 6. Mix until flour is moistened.
 7. Pour batter into baking pan and sprinkle on topping.
 8. Bake at 350° for 30 – 35 minutes or until toothpick inserted in the center comes out clean.

Taken from Deborah's book *Fruits, Roots, and Shoots: Using Tropical Plants for Self-Sufficiency* soon to be published.



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International Federation of Organic Agriculture Movements

The Economics of Industrial Hemp

By Karin Westdyk



The U.S. currently imports an estimated \$2 billion worth of industrial hemp each year. Though it is the world's largest consumer of hemp and hemp products, US farmers have not enjoyed "harvesting" the benefits of growing hemp for the better part of a century.

Based on disinformation, created and fueled by those who benefitted from its prohibition, a war was waged against a plant with the potential to provide quality food and shelter, a carbon-negative fuel, strong fiber and paper, and an effective medicine where pharmaceuticals have failed. Using racism and "fake news" hemp was vilified and since 1937, banished from the landscape, allowing fossil fuels to dominate agriculture, energy, and products that have caused great havoc, leaving a trail of pollution, illness, and war.

But this is changing...

Twenty-eight countries now support hemp farming, mostly in Europe, China, India and Canada, and hemp has indeed enhanced the economies, wherever it is grown.

In the Caribbean, Jamaica is developing an agro-industry with its focus on producing hemp medicine. Audley Shaw, Jamaica's Industry, Commerce, Agriculture and Fisheries Minister is working to help his country take advantage of what he described as a "multi-billion dollar global industry".

More and more companies involved with producing hemp products have now gone public, raising capital by selling shares in the stock exchange to grow their companies, and some of these companies are indeed posed to soar.

Recently, in the US, hemp has drawn support from both political parties, as legislators have learned more about how hemp can provide much needed revenue streams to farmers across the country. In June the US House of Representatives passed the 2018 Farm Bill. This bill describes industrial hemp as an agricultural commodity, effectively removing it from the list of controlled substances where it was erroneously placed 81 years ago. On June 13th, The Senate Agriculture Panel approved the farm bill with hemp legalization in a 20-1 vote, and on June 28, the Senate passed the farm bill with a bi-partisan vote of 86-11.

This all came on the heels of the US Federal Drug Administration's Advisory Committee Meeting which declared a unanimous positive analysis for Epidiolex, a cannabis derived medication to treat 2 rare forms of epilepsy and was fully approved by the FDA

on June 25th. This acceptance also invalidates the plant's schedule 1 status, which had claimed that cannabis had no medical use. It is currently being widely explored as a treatment for cancers and other diseases with promising results. In addition, The World Health Organization has declared cannabidiol (CBD), found only in cannabis hemp, to be a proven effective treatment with no evidence of health-related problems or indications of abuse.

This recent broad approval for cannabis has likely ignited its explosive growth. Hemp has an estimated \$500 billion annual potential worldwide market, because anything made from trees, cotton or petroleum can be made from hemp. Today, it is estimated that more than 25,000 products can be made from hemp including carbon negative bio-fuels from both seed and cellulose, a highly nutritious food and oil from its seed, fiber that is stronger and cleaner than cotton, a more durable and eco-healthier building material, and a universal medicine -- once deemed by the ancients as kingly because of its ability to cure so many illnesses with no side effects. New industrial uses and health-care products are being discovered every day from biodegradable plastic bags and composite products, including car bodies and building materials, to new health care products and medicines, insuring the growth and viability of the hemp industry for all who support it in years to come.

Some interesting concepts to ponder: In 1938, *Popular Mechanics* magazine announced that a new method for processing hemp would make hemp the next billion-dollar crop. In today's market, this would translate into nearly \$18 billion. It has been estimated that by 2020, the US will realize \$44 billion in economic impact dollars from its growing hemp program. In 2016, with only one harvest per year, Canadian farmers exported to the US \$45 million worth of hemp seeds. In the tropics, 2 to 3 harvests per year are possible.

Hemp Business Journal estimates the total retail value of hemp products sold in the U.S. in 2016 was \$688 million. Hemp oils alone generated \$139 million in sales, and oil sales are projected to reach \$350 million by 2020. Based on consumer data, a report in the *Hemp Business Journal* is projecting that by 2020, the market for CBD products will reach \$2.1 billion in sales, and a recent report published by Arcview Market Research and BDS Analytics, claims worldwide spending on legal cannabis will reach nearly \$60 billion by 2027.



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Protein Bank Update

By Chris Harris, White Rock Farm



Quite a lot has happened since the first article about our protein bank. (See Belize Ag Report, issue 39.) In truth we have learned quite a lot. It's a good news/ bad news story really. First the good news: we have been able to save quite a bit of money in proprietary feed costs. To be honest however, that was the easy part. Just don't buy....!!

The bad news is that our broiler growth rate dropped significantly when we substituted natural grass/leaf feed for part of the broiler grower we had been using. For those who might have missed the first article, we have been growing a number of high protein shrubs and grasses in order to reduce our expenditure on conventional proprietary feedstuffs. This approach has been called a *protein bank*, rather common elsewhere in the developing world. So it has been a matter of experimenting to see how much feed we could replace without major growth rate reductions. This experiment is still ongoing. It is likely we will end up with around a 25% reduction in feed costs, perhaps more. We shall see.

We are feeding this chopped up grass and leaf mixture to our pigs, calf, rabbits and sheep who are eating it enthusiastically. The goats prefer the un-chopped leaves which is just as easy to feed, although they prefer them hanging up to just being thrown into the feeding area. Growth rates are much harder to measure for these animals, but the sheep and rabbits in particular are notably enjoying the feed and putting on weight well. Once we get into the dry season when natural pastures quickly become bare, this feed will be invaluable.

In passing, we have begun adding a small quantity of kelp to our feed. Since we started doing so, we have noticed an increase in milk production amongst our goat herd.

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As far as producing the natural feed mix itself is concerned, that has been a dramatic success. The Maralfalfa grass grows like wildfire. We have now had three crops so far this year from this 10 foot high protein grass. Similarly the white mulberry has shown excellent growth and we are pollarding the bushes and using the tender shoots for additional feed. Other feed plants under cultivation include cassava, white yam, ramon, nasadera, milo, black corn and leucaena which we will add into the mix in due course. Of these only the nacadera is showing slow growth; everything else is racing away.

We also have recently started planting more breadnut trees since we discovered that in addition to being excellent pig food, the nuts themselves boiled and then roasted taste exactly like the chestnuts we used to roast beside the fire back in England! The breadnut tree is easily propagated from its seeds and is fast growing. Fruit can be expected in four years. Our original seed came from Chris Nesbitt at Maya Mountain Research Farm, and the tree has been bearing since it was about three years old.

To get a sufficiently high protein content, it's necessary to fertilize at least twice a year. As we have ample supplies of rotted chicken and goat manure we are fertilizing more often than that, as we feel that our heavy rains tend to deplete the soil quickly. After all, it's leafy growth we are after, and high nitrogen should produce that.

One of the beauties of growing your own feedstock is that many other plants can be added into the mix. For instance, we have chopped up sweet corn and sunflower plants after the seeds have been harvested, madre de cacao, sugar cane and moringa all of which are very nutritious and in the case of madre de cacao, have mild vermifugal properties which are a useful addition to the mix.

We will continue to follow progress of this project and report back in due course.

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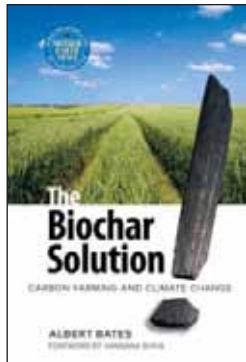
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THE BIOCHAR SOLUTION - Carbon Farming and Climate Change

By Albert Bates

Reviewed by Chris Harris



The first thing to say about this book is that it is not for the deniers of climate change-or perhaps it is...

By tracing the origins and history of agriculture around the world, from the very beginning of man's involvement in life on "the third rock from the sun" the author presents a plausible account of the highs and lows of our struggle with nature and the impact on our future.

Around 400,000 years of history from cave paintings through to modern day scientific research has given us a fascinating story of success and failure, of the rise and fall of civilizations and the impact on food production over the years.

Much of the book focuses, not surprisingly, on some of the oldest known civilisations in Central and South America, Africa and Asia. Brazil is singled out for the areas of very fertile soil appearing in places not known for their fertility. Analysis has shown that these areas are all that remains of long gone civilizations which over centuries dumped their waste, both human and vegetable, in confined areas. Of course in those far off days waste would have been quite different from today's typical landfill. The accumulation of their waste over hundreds of years, combined with ash from cooking fires led to areas of high fertility. Such accumulations have been found elsewhere and in most cases remain the only indication of the existence of ancient civilizations.

The earth in these areas of high fertility was dubbed terra preta or black land. The proof of their origin lies in the discovery and carbon dating of manmade ceramics embedded in the terra preta. The conclusion: terra preta was made by the Amazonian Indians thousands of years ago.

The grim reality is that over the millennia man has turned fertile areas into deserts by cutting down forests, and mismanaging valuable and vital water resources. At the same time the effects of our evolving lifestyle has seen a dramatic rise in overall temperature which scientists say is likely to keep rising with eventually catastrophic results.

The author repeatedly warns that unless we start husbanding our resources more efficiently we are doomed to follow ancient civilizations into extinction. Bates further indicates that if this warning is not heeded, we will reach a tipping point beyond which recovery will not be possible. He hints that that day may not be far off. The message is clear: we ignore the history of our world at our peril.

Having read this far in the book, you can imagine, I was looking for salvation, a route to minimize this very worrisome analysis. Of course there is no panacea, nothing even remotely resembling a magic formula to save us all. Instead there is a quite gentle suggestion that we must mend our ways within the farming community. Naturally this cannot happen on a global scale without strong political will, a will which so far from the Rio de Janeiro conference right through to Kyoto and then Bali, has been singularly lacking.

But the author still shows that by improved husbandry of our land we, the farming community, can make a significant difference. How? Well, by pulling carbon out of our atmosphere and getting it back into the soil.

Apparently the imbalance between carbon held in the ground, and carbon in the atmosphere is a major contributor to global warming.

And so after all this, finally a reference to the title of the book; carbon. It came as something of a relief to read that the absorption of carbon from the air can make a positive contribution to slowing global temperature rises. From a farming point of view, this involves returning waste and compost back to the land to allow sequestration of carbon. Of course only a fool would think it was that simple and the author makes the point that the way we produce food is equally important. It takes 16 lbs. of grain to produce 1 lb. of beef. We are choosing quick, easy, and above all, cheap routes to food. This is being achieved largely by monoculture. The author asserts that the time will come when food production will be unable to meet the escalating demand from a hungry population worldwide.

And so to biochar. Plainly speaking, biochar is charcoal pure and simple. But charcoal is far from a simple substance. Each piece is a micro honeycomb of thousands of holes, which attract microbes, bacteria and moisture. These microbes sequester carbon in order to grow and multiply. Biochar then, if introduced to the soil, can, over time, radically improve soil fertility; most importantly, by increasing microbe populations, it can increase the absorbed carbon.

The author acknowledges the significant research into the importance of biochar being carried out here in Belize by Christopher Nesbitt at his Maya Mountain Research Farm near San Pedro Columbia in southern Toledo.

Finally the book gives an overview of the methods of making biochar, from the simple (but environmentally unsound) Mayan piles of logs buried in earth and fired, to quite sophisticated burners which can supply biochar and electric power.

This is not an easy book to read, by which I mean it's a bit disturbing, and also a bit technical in places. Some of its assumptions and statements are even now disputed in some quarters. However there is no denying that biochar technology, although still in its infancy, seems to have much to offer to the practical farmer.

The Biochar Solution by Albert Bates
Published by New Society Publishers
PO box 189 Gabriola Island BC
VOR1X0 Canada

Editor's Note: Author Albert Bates has a new book co-authored with Kathleen Draper, Carbon Cascades: Redesigning Human Ecologies to Reverse Climate Change, to be released in November 2018. Learn more about biochar at the Transforming Tropical Agriculture conference, November in Belmopan (see pgs 20-21) in a presentation Belizean-American Christopher Nesbitt of Maya Mountain Research Farm.



**Food and Drinks
with a View**

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AG BRIEFS



Regeneration Belize and Regeneration International will present a 3 day farmers' conference, Transforming Tropical Agriculture, on 13-14-15 November at the NATS grounds in Belmopan. Admission is free and all farmers are encouraged to attend. Details on page 20. Email regenerationbelize@gmail.com or visit Regeneration Belize's Facebook to pre-register.

Acres USA will present its **43rd annual Eco-Ag Conference & Trade Show December 4th-7th** in Louisville, Kentucky. Information: info@acresusa.com



World Food Day 2019 will be celebrated in Belize on Friday, 19th October at the Julian Cho High School, Toledo District, with the opening ceremony commencing at 9:00 AM. This is a collaborative effort between the National Food and Nutrition Security Commission, the Ministry of Agriculture FFESDI and The Food and Agriculture Organization (FAO) of the United Nations. For more information email peu.secretary@agriculture.gov.bz or Emilio.montero@agriculture.gov.bz

Avocado chips? Yes, go to the FaceBook page of AvoLov, to learn more about chips made from Hass avocados, in Oregon. Innovator CEO Eric Healy was formerly an aerospace engineer, but was raised in a food-oriented family; his uncle was the founder of Kettle Foods and his parents the founders of the No-Bake Cookie Co. Current healthy eating attitudes including the popularity to good fats (coconut and avocado) and dehydrated fruits and vegetables have contributed to the creation and success of his chips. A low-temperature process and a few natural additives such as tapioca starch are part of the procedure.



Meanwhile in New Zealand, The Otago University Department of Food Science has developed a **"pulsed electric-field processing method which ... might turn French fries into a healthier, environmentally-friendly snack option.** The PEF machine uses microsecond-long pulses of electricity to alter

the microstructure of uncut potatoes.... Resulting in a more controlled release of sugar, a reduction in oil uptake,resulting in potatoes which are easier to cut, leading to reduced waste production..." For more information: <http://www.odt.co.nz/news/dunedin/campus/university-of-otago/otago-uni-scientists-chase-dream-guilt-free-hot-chip>

"Another day in paradise" was the daily greeting of **Belizean American Lou Thomas, internationally renown palm farmer of Teakettle Village.** Lou arrived in Belize over 35 years ago on his honeymoon, fell in love with Belize, walked away from a lucrative engineering career in the US and moved to Belize and never left. He farmed over 500 varieties of palms collected from all parts of the world on his pesticide-free 80 acre farm which was his life's work. Lou passed to his second paradise on 21 July 2018. God speed on the new journey, Lou.



In 2003, the leaders of the **Indian state of Sikkim**, population 610,000, located in the Himalayas between China, Nepal and Bhutan, made an unprecedented decision. Having observed that India's industrial farming areas experienced not only polluted rivers and gradually infertile soil, but also increased cancer incidence, they **designed and implemented a gradual shift moving their farmers first to pesticide-free then to organic agriculture.** The government gradually cut down on pesticide imports over 11 years, the phase out becoming complete in 2014. By 2016, 190,000 acres in Sikkim were certified organic; overall India has about 400 M acres of farmland of which about 5 M acres are pesticide-free.

Sikkim's transition to organics has led to an increase in tourism. Arrival rates doubled between 2011 and 2017 and in 2014 *The Lonely Planet* named it *The World's Top Destination*. India hopes that Sikkim will be a model for other states wanting to go organic. The Indian states of Kerala and Meghalaya, as well as the kingdom of Bhutan, all plan to go exclusively organic. India's organic food market is growing at 25% a year; global increase is about 16%. Single-used plastic dishes have also been banned in Sikkim, replaced with plates made from leaves.

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



★ Same

	Cayo, Belize	Quintana Roo, Mexico	Peten, Guatemala
REGULAR	↓ \$11.14 Bz/Gal	↑ \$7.89 Bz/Gal	↑ \$8.25 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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This month, Sept 2018, France banned 5 neonicotinoid insecticides: clothianidin, imidacloprid, thiamethoxam and thiacloprid and acetamiprid, due to their inadvertent dangers to commercially important pollinating insects such as bees.

Many scientists suggest that this family of pesticides, referred to as neonics, have an addictive effect on insects, similar to nicotine's to people. The neonics are shown to reduce bee reproduction and also scramble the insects' memory and navigation functions. Three quarters of all crops depend on pollinators (mostly bees) and the UN warns that almost half of insect pollinators risk global extinction. Meanwhile, grain farmers and sugarbeet farmers in banned areas complain of unfair competition from farmers who still have legal access to these products. Canada has also announced plans to gradually phase out clothianidin and thiamethoxam.

Russian scientists at the Tomsk Polytechnic University have developed a robo-bee, intended only for use in year-round greenhouses.



Testing will begin with the robo-bees, which are about 7 times larger than live bees, with greenhouse strawberries in 2019. Russian farmers currently use bumblebees for large greenhouse pollination. However these can and do escape. In Japan engineers at the National Institute of Advanced Industrial Science and Technology developed a drone which has successfully pollinated lilies. Harvard has developed a robo-bee with smart sensors which mimic eye functions of real bees; The Charles Stark Draper Lab, also in Massachusetts, is working on a robot *Dragon EYE* for guided pollination; lastly, even Walmart filed a patent for a drone pollinator earlier in 2018.



Sergio Gamberini, a chemical engineer in Noli, northwest Italy, who owns a scuba diving equipment business, began experimenting about 5 years ago with **growing plants underwater.**

Since Italy has laws preventing permanent underwater structures, Gamberini now has 6 greenhouses about 22 feet under sea level, *Nemo's Garden*, made of plexiglass and steel, screwed down to the seafloor and growing a variety of plants such as basil, tomatoes, greens, strawberries, mint, marjoram and others. Light at that depth is about 70% of surface light. In winter and when weather requires, the light is supplemented by LED lamps which are powered by solar panels and a wind turbine. Fresh water is also tubed into the gardens to supplement the naturally de-salinated water (from condensation on the interior walls). Chemists have found that plants grown in this undersea environment with atmospheric pressure higher than for land plants have higher concentrations of eugenol and chlorophyll. Pharmaceutical companies are testing medicinal and cosmetic uses for these undersea-grown plants. Environmentalists have some question as to the long-term impact on the sea. Gamberini welcomes any certified diver to come check his site, saying September is the best time to visit Noli.

Find all the Belize news sites linked from one site, including the Belize Ag Report.



The Agricultura Abierta y Protegida de la Peninsula Company headquartered in Mexico's Yucatan state announced plans to process habanero peppers to extract the capsaicin molecule for export.

Capsaicin has shown to be useful as a wood treatment against pests, as a protection for fiber optic cables, in self-defense, as a pain reliever and an inflammation reducer. Owners Francisco Irazoquiel Galaviz and Jose Maria Sabin Sabin have taken almost 5 years to successfully develop a high-tech greenhouse that combines the attributes of greenhouse and shade-house with hydroponic production equipment in order to harvest all year. Currently the company farms 11.5 ha in Hoctun, Yucatan, and exports about 920 tons of fresh habaneros for food per year. They plan to open their processing facility to isolate the capsaicin by the end of 2019, with 100 ha in production and approximately 1500 people employed. Their eventual goal is for 1000 ha with a continuous greenhouse harvest. Germany, Spain and the US have expressed interest in purchasing the capsaicin molecule product.



On 10th August 2018 a ruling from the Superior Court of California in San Francisco was heard around the world. Former school groundskeeper Dewayne Johnson sued RoundUp maker Monsanto after he contracted a lethal form of Non-Hodgkins Lymphoma suspected to be caused by heavy exposure to the RoundUp while spraying the herbicide.

Secret internal Monsanto documents released to the court and the public during the trial exposed that Monsanto had known for decades that RoundUp could cause cancer. Attorney Robert F. Kennedy Jr, who is working on other glyphosate and RoundUp cases, stated that growing evidence suggests glyphosate/RoundUp may also be linked to liver cancer, brain tumors, and health problems associated with endocrine disruption. Judge Suzanne Ramos Bolanos announced in court that "Monsanto..... acted with malice, oppression or fraud and should be punished for its conduct". A 12 person jury deliberated for 2 and a half days after which the court ordered Monsanto to pay Johnson \$39M USD for past and future losses and \$250M USD in punitive damages. Monsanto will appeal. Bayer Stock (German stock market , as Bayer recently consummated purchase of Monsanto) fell by 18% after the ruling. Stock experts attribute some of that

Continued on pg 30



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Ag Briefs...Continued from pg 29

loss to many pending lawsuits concerning their dicamba products. RoundUp is registered as an herbicide in 130 countries, including Belize. RoundUp is the most used pesticide worldwide, and is the highest volume pesticide imported into Belize for many years. The International Agency for Research on Cancer (IARC), part of the World Health Organization (WHO), classified glyphosate as a 'probable carcinogen' in 2015.

The abundance of press on glyphosate from the California ruling has now created global interest not only in RoundUp's use as an herbicide, but also in glyphosate's use as a crop desiccant, or pre-harvest treatment to speed up ripening of grains. Monsanto has stated in brochures that "RoundUp is not a desiccant"; however farmers continue its use as one on both GMO and non-GMO crops. If Roundup/glyphosate is "applied too early, while the grain has a moisture rate higher than 30%, the glyphosate is absorbed through the leaves and stems and translocates throughout the plant". This pre-harvest spraying of RoundUp is now blamed for contamination of hundreds of processed foods containing various grains. Other chemical desiccants include paraquat and diquat. Currently no standard food testing is in place for any of the commercial desiccants; this may be changing as the risks of costly litigation increase dramatically and buyers demand more residue testing.

Shift in avian extinction patterns: BirdLife International commented recently on the trend change in bird extinctions. Whereas previously most bird extinctions were small island species, their chief scientist Stuart Butchart explains that "an extinction crisis is now unfolding on large continents, driven by human habitat destruction". Eight new extinctions were identified in South America, 4 of which occurred in Brazil.



EPA Report Shows Ethanol Hurts the Environment By Jason Hopkins | Energy Investigator

In an extensive study, "Biofuels and the Environment: The Second Triennial Report to Congress," the Environmental Protection Agency (EPA) determined that ethanol derived from corn and soybeans is causing serious harm to the environment. Water, soil and air quality were all found to be adversely affected as a result of biofuel mandates.

Greater biofuel production has resulted in more harmful algae blooms and hypoxia. While most algae are harmless to water, some forms, such as the kind produced in Lake Erie from biofuel feedstock, emit toxic chemicals into the water. This harmful algae can consume the oxygen in the water, a process known as hypoxia, killing other wildlife.

Increased irrigation, fueled by growing demand for ethanol, has also taken a toll on soil, with the report finding "grassland-to-annual-crop conversion negatively impacts soil quality because it increases erosion and the loss of soil nutrients."

"Air quality modeling suggests that production and use of ethanol as fuel to displace gasoline is likely to increase such air pollutants as PM2.5, ozone, and SOx in some locations," read a section of the report pertaining to air quality. While traditional gasoline contains more CO2, ethanol-based fuels have more nitrogen oxides (NOx), which can be more harmful to human health. NOx can exacerbate asthma by causing inflammation of the respiratory airways, with long-term exposure resulting in decreased lung function.

The mandate in reference concerns the Renewable Fuel Standard (RFS), a 2005 law that requires oil refineries include a certain amount of ethanol in their fuel mix. The law was passed with the intention of aiding climate change efforts. The RFS has proven to be controversial, with oil producers deriding the mandate as costly and unneeded while corn producers support it because it drives up demand for their product.

Management for Sustaining the Vaca Forest Reserve By Sarah Ottinger and Elizabeth Becker



This is the first in a series of articles to be written by college research students involved in projects to study human impacts on the Vaca Forest Reserve (VFR), a protected 15,314- hectare multi-use conserved area of land located in western Cayo. VFR provides renewable resources to the surrounding communities of Arenal, San Jose Succotz, and Benque. The students come from multiple US universities including the University of Tennessee, University of Florida, State University of New York, and North Carolina State University. They are focusing on agricultural plant and soil science, forestry, wildlife, and human/social dimensions of the VFR. Their work complements the efforts of Friends for Conservation and Development (FCD) currently working in the VFR to pioneer a landscape management program that will benefit farmers, local communities and the environment. Findings of the research team regarding the soil and cropping systems are the focus of this report.

The cropping arrangements of 49 fields in the VFR were determined in order to assess the field size, crop species, densities, and abundances. Soil samples were collected from 41 of the fields in the VFR to assess the physical and nutrient properties of the soil. The soils were found to be in normal ranges for most nutrients, with a few sites showing low phosphorus levels. This is not surprising for highly-weathered tropical soils. The Vaca soils, generally high in nitrogen, are suitable for agriculture without extreme chemical inputs. Soils consistently had a high-clay content throughout the VFR, and the soil pH tended to be slightly acidic. Clayey soils hold water well, but may have difficulty draining if oversaturated. Fields that host crops that are sensitive to waterlogging such as corn should not be over-irrigated, especially during the rainy season.

Good farming practices include cropping annual and perennial plants together in the same field to reduce pests, increase water-holding capacity, prevent soil erosion, and increase soil nutrients. Planting fruit or nut trees together with vegetable crops also helps reduce the risk of pest invasions as pest predator habitat (e.g. trees for bird habitat) increase. Planting trees with vegetable crops also holds the soil; the roots prevent erosion and the fallen leaves add nutrients to the soil. It is vital to continue to add both nutrients and organic matter back into the soil to maintain soil health and productivity. Simply keeping the soil covered with either crop residues or a secondary crop can make a big difference for preserving the integrity of soil in the VFR. Some of the fields in the Vaca did take advantage of intercropping methods; commonly intercropped species are lime and pineapple, banana/plantain and pepper, corn and squash and corn and mango.



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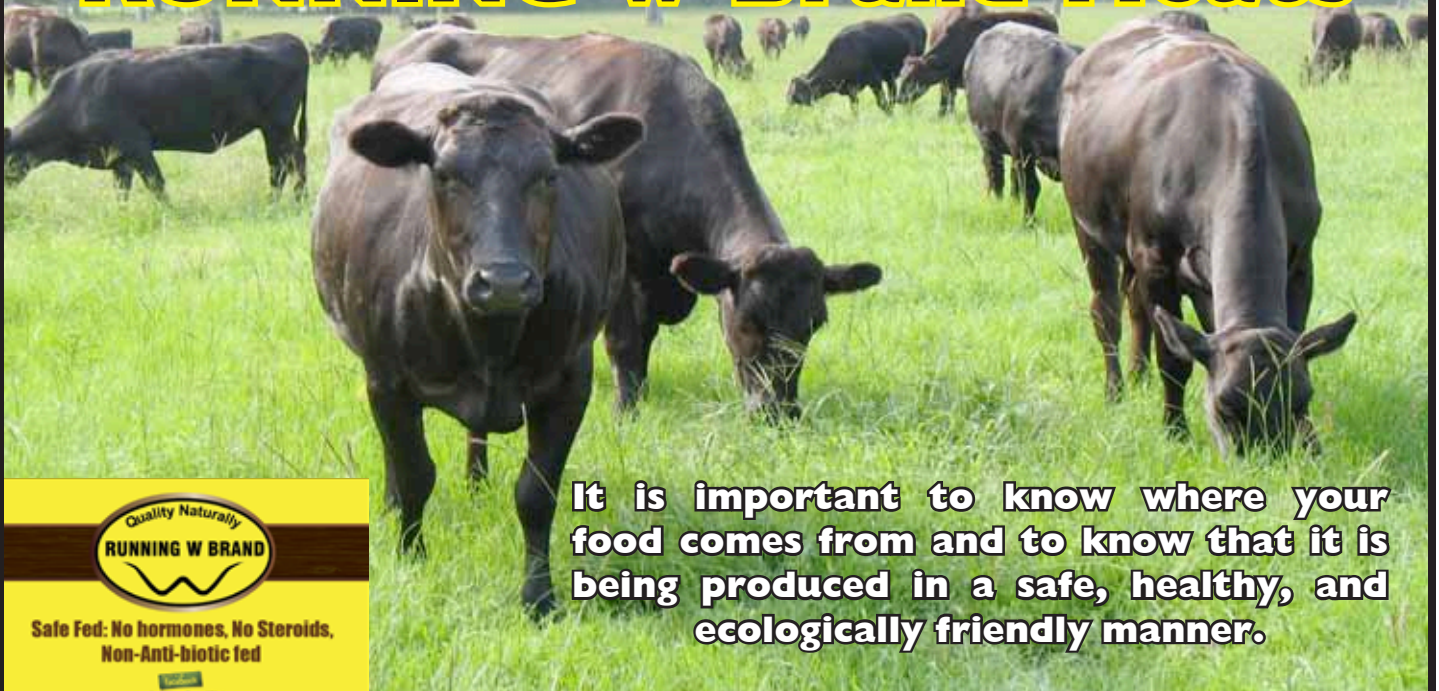
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