The Belize Ag Report

Belize's most complete independent agricultural publication

March 2018
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BELAGRO
AGRICULTURE
Agricultural Solutions
for Greater Yields

BELAGRO AGRICULTURE'S NEW LINE OF PESTICIDES

BELAGRO AGRICULTURE

Big Creek Group
Companies in Touch with Tomorrow

ASULOX 40 SL

Presentations: 1 L, 5 L, 10 L, 20 L , 110 L

Type: Herbicide

Active Ingredient: Methyl sulfanilylcarbamate (Equivalent to 400 g/L of Asulam present as the sodium salt)

Range of Pests: Weed grasses—some annual and perennial, broadleaf weeds. Excellent for the control of *Pteridium aquilinum* (male bracken fern) in paddocks.

Range of Use: Sugarcane, rice, pastures, melon-watermelon.

Mode of Action: Selective with post-emergence action.

Mechanism of Action: Inhibits cell division and expansion at the meristem level. Possibly interfering with the formation of microtubules or their function. It also inhibits an enzyme that intervenes in the synthesis of folic acid preventing the formation of purine.

Compatibility: Mixing with 2, 4-D, fluroxypyr, picloram, etc. is recommended. It should be used in conditions where the weeds are actively growing.

UPSTAGE 50 EC

Presentation: 1 L, 10 L

Type: Herbicide

Active Ingredient: Clomazone

Range of Pests: Annual grass weeds and some annual broadleaf weeds.

Range of Use: Rice- *Echinocloa colonum, Digitaria sanguinalis, Eleusine indica, Cynodon dactylon, Paspalum pilosum.*

Mode of Action: Pre-emergent and early post emergent.

Mechanism of Action: Metabolizes to the keto-5 clomazone form, which inhibits the enzyme deoxy-D-xylulose 5 phosphate synthesis. Inhibition of carotenoid production which cause photodestruction of chlorophyll and results in whitening of the developing leaves.

Compatibility: It is compatible with other herbicides such as pendimethalin, butachlor and pretilaclor. It is always recommended to make a previous test of compatibility with other products.

HERBICIDA Select 24 EC

Presentations: 250 mL, 1 L, 10 L

Type: Herbicide

Active Ingredient: Clethodim

Range of Pests: Guinea Grass (*Panicum maximum*), Jaragua (*Hyparrhenia rufa*), Gamalote (*Paspalum* spp.), Johnson grass (*Sorghum halepense*), Water grass (*Echinochloa* spp.), Crow foot grass (*Eleusine indica*).

Range of Use: Beans, Onion, Beets and Melon.

Mode of Action: Post-emergent, systemic and selective control.

Mechanism of Action: Acts systemically in the meristematic tissues inhibiting cell division. It is rapidly absorbed and translocated from the treated foliage to the growing parts of the plant and the root system.

Compatibility: It should not be mixed with other products. Some antagonism has been found within tank mixtures with some post emergent herbicide for control of broadleaf weeds.

LIFELINE™

Presentations: 5 GAL, 30 GAL (1 Drum)

Type: Herbicide

Active Ingredient: Glufosinate ammonium

Range of Pests: Broad spectrum range of grass—annual and perennial, broadleaf weeds—Eg. Marestail, hairy fleabane, malva, and filaree.

Range of Use: Broad range (100 Crops) – 2 key crops are: citrus, potatoes and olives

Mode of Action: Non-selective, post-emergent action.

Mechanism of Action: Glufosinate of ammonium acts by inhibiting the enzyme glutamine synthase. Results in an accumulation of ammonium in the leaf tissue and gives decrease in photosynthesis resulting in decrease of the number of key amino acids that affects protein synthesis, death is given by the joint effect.

Compatibility: Compatibility test required for some intended tank mixes .

Energy Production from Organic Waste

By John Downard

Reliable energy is critical to all world governments and available renewable energy production has become a focus of industry worldwide. Belize purchases about 46% of the country's power from Mexico at a cost of $137 million USD per year, 38% from Belize Electric Company Ltd., 2% from Hydro Maya, and 10% from Belize Aquaculture Ltd. Belize Electric Company Ltd., and Hydro Maya produce power from dams that supply hydro power generation. Hydro power generation is a renewable reliable form of energy that requires large investment in resources to establish, maintain, and service to ensure reliable power supply and is limited to locations suitable for dam construction. Silting of water intake systems is currently a mounting issue in Belize. As a developing country, Belize needs to evaluate its current position and look into the future as demand for safe, affordable electric power increases. Dependence on electric power from neighboring countries creates a position of dependence. Furthermore, supply interruptions have a profound impact on the safety of Belize citizens.

Solar, wind, and hydro are also recognized as renewable forms of energy but these are somewhat dependent on factors that cannot be controlled. Solar is dependent on hours of sun light and the efficiency of converting light to electric power. Wind is dependent on the speed of the wind and the days wind reaches desired velocity. Hydro is dependent on rain fall and maintenance of systems to direct water pressure to generators.

Another form of power production from renewable sources is based on organic waste that uses combustion, "burning," of materials for heat generation; heat is used to generate steam that is then converted to energy. The combustion of organic materials such as bagasse is currently being employed by the sugar industry to supply power to cane processing facilities. The combustion of organic materials has negative side effects that need to be taken into consideration; for example, the emissions from combustion, and the scaling generated in the combustion chambers. As scaling of the interior of the combustion chamber increases, the efficiency of heat exchange is reduced. The removal of the scaling requires that the furnace be shut down and cooled for workers to enter the chamber to remove scaling. This maintenance creates loss of electric power production and revenue loss on multiple levels.

How about converting organic waste without the use of combustion? Atlas Energy has patented a revolutionary process that is able to convert organic waste into 6 revenue generating products without the use of combustion: metallurgical coke, dry fertilizer, bio diesel, potable water, excess heat, and megawatts of electric power. The abundant and never ending supply of organic waste in Belize offers a reliable resource for power production. The ability to scale an organic waste processing system can be strategic in matching a facility to the local demand of power consumption and the supply of local organic waste production. The Atlas Energy system can accept unlimited types of organic waste. Crop residue, grass and tree cuttings, beach sea grass, black water from local communities, manure from livestock, food waste from restaurants, cardboard and paper products can all be used in the process of power production. The capital investment in power production is evaluated by return on investment (ROI). The Atlas Energy system is able to reach ROI in less than two years, a time scale that has not been seen in this industry.

The production of electric power and multiple revenue generating products provides a unique opportunity for Belize. The collection, transport, and processing of organic waste offer economic advantages on multiple levels; for example, reducing waste load on landfills and reclassifying organic waste for power production introduces a new industry that is highly desired. Establishing multiple facilities in different locations provides a decentralized power production system and provides job opportunities for each community where systems are developed. Proximity to waste sources reduces costly transportation of waste to a single processing facility. A network of interconnected power production facilities provides a smart system that is able to coordinate power production to ensure demand is supplied from multiple locations. Decentralized power supply reduces power outage by absorbing demand in the event of one facility going down. As demand for power drops, managers are able to coordinate power supply for potential sales to other countries.

The creation of jobs, addressing organic waste impact issues, and sustainable power production can provide Belize a future that is realistic and obtainable. ThuNu Ltd., a Belize registered company and regional representative of Atlas Energy, is currently talking with other private companies in Belize to evaluate strategic locations that offer the best potential for success.

Comments or questions to: johndanieldownard@yahoo.com

From the EDITORS

Industrial Hemp

Since the re-classification of industrial hemp in November 2017, several people have asked us for more information about it. Larger Belizean farmers ask, 'Is this a good economic opportunity?" Others wonder how to differentiate this fibrous industrial plant from the more well-known marijuana (aka ganja). Both are in the genus Cannabis; page 32 of this issue is an article by Karin Westdyk that might help clarify things for you. Photos in the article highlight differences that even a non-farmer can appreciate.

Industrial hemp has a long history for food, fiber, cloth, paper, construction and many other uses, which have been covered in previous Belize Ag Reports as part of a hemp series by Karin Westdyk.

We recommend for more information the links below: https://www.theguardian.com/society/2017/feb/04/hemp-plant-that-could-boost-americas-economy

A political battle**:** America already safely consumes $580m worth of products made from imported hemp every year – from milk to T-shirts to soaps. Yet because it has been illegal to import or cultivate seeds, the farming, processing and manufacturing jobs associated with hemp belong to the 30 countries growing it, from Canada to France to China.

"We are the only industrialized nations not to allow it," says Joseph Yost, a Republican member of Virginia's state legislature and hemp supporter, who points out that hemp could replace tobacco as a cash crop and bring back some of the manufacturing jobs that have left his state....."

And from *Forbes*:

https://www.forbes.com/sites/ashoka/2013/05/29/industrial-hemp-a-win-win-for-the-economy-and-the-environment/#4fa0b654289b

and from the Canadian government: https://www.canada.ca/en/health-canada/services/health-concerns/controlled-substances-precursor-chemicals/industrial-hemp/about-hemp-canada-hemp-industry/statistics-reports-fact-sheets-hemp.html

Building Topsoil

On another note – we recommend everyone interested in building topsoil to study the interview with Australian soil scientist Dr. Christine Jones, which starts on page 9. As Neal Kinsey opines in his article in this issue, much has changed since many of us attended our first Agriculture 101 class. It may take you several sittings to digest this long article, but those that do will find it well worth the effort.

Unplanted Bounty follow-up

A follow-up on the *Unplanted Bounty* article in our November 2017 Issue #38, pg 26, reveals that the wild squash was 'Sikil' – see *Wild Squash or Wild Pumpkin (Sikil)* by Harold Vernon in our May 2016 Issue #32, pg 38.

Joel Such, birder:

Readers who enjoyed the bird article, *Exploring the Avian Wonders of Belize* by Joel Such, in our February 2017 Issue #35, may enjoy his website: www.JoelSuch.com Joel kept on birding in Latin America after passing through Belize – even volunteering alongside the authors of the 2016 *Peterson Field Guide to Birds of Northern Central America*, Jesse Fagan & Oliver Komar. Although Joel was only a teenager when he began his Latin sojourn, we expect to see and hear much about this astute and very precocious birder.

Beth & Dottie

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Ministry of Investment, Trade and Commerce

The Sweet and Sour of Sugar

Production Increase to a Vital National Industry

By John Rivero

The latest export figures for 2017 highlight the significance of the sugar industry to the country; 35% ($157.8 Million) of the total national export revenues of $445.6 Million is derived from the exports of sugar (and molasses). The figure in 2016 was only $110 Million, reflecting a substantial 43% increase. With the addition of Santander entering the production phase, the volume of sugarcane production and processing has significantly pushed national output levels. Cumulatively in 2016, the national sugarcane deliveries rose by 24.6% to 1,455,053 long tons, of which the North and Santander accounted for 1,292,515 long tons and 162,538 long tons, respectively.

The Central Bank Annual Report 2016 indicated that except for the increasing production of sugarcane, output plummeted for nearly all the major export crops, and this resulted in a 24.9% drop in the value added to the primary sector. The causes of recent reduction in national supply capacities included several factors: citrus greening; closure of the largest papaya production company; temporary closure of the Meridian group of banana farms; a difficult recovery from the EMS outbreak in the shrimp industry; and Hurricane Earl causing havoc across the citrus and banana belts.

Despite a 10.7% growth in deliveries in the North, depressed prices prevented farmers from realizing gains from the increase. The Central Bank reported that the average price in 2016 plummeted by 45.3% to $52.24 per long ton, following the anticipated downturn in preferential sugar prices on the European Union (EU) market and notwithstanding a 50.0% increase in the local price of plantation white sugar. BSI-ASR confirms that final sugar cane payment for 2016 was $52.24 per ton, while for the previous year, 2015, the final price per ton was $75.89, representing a drop of $23.65. The increase in the national price of plantation white sugar went from $44.42 per bag to $76.74 (almost doubled), but only about 9 – 10, 000 tons per year is sold on the domestic market. Conversely, 90 - 95, 000 tons of bulk raw sugar go to the EU along with another 20, 000 tons in bags (1-ton and 25 kg).

BSI-ASR also stated that while the bagged sugars attract a value-added premium and is a higher quality, direct consumption sugar, the reference price basis for calculating the premium, is now at a lower EU market price. What was once a preferential price for the EU market, has now moved closer to par with world market prices. With about 85% of the product going into the EU, the significant drop in prices caused by the removal of preferential prices, is ultimately transferred to the local farmers. World market prices for molasses have also dropped steadily over the last 2 years from around US $115 per ton to US $75 per ton, due primarily to increased production in areas like India, Pakistan and Brazil. Ethanol production has not been as dominant as previous years due to the fall in prices for fossil fuel worldwide

Sugar for the Region

The high cost of producing sugar in the Caribbean derives from lower levels of productivity which are limited by the region's small scale of farming and operations of factories. Productivity is low by international standards. Brazil, with huge productions and operations, is seen as the natural price-setter in the world market. The reform of EU sugar policy in October 2017 resulted in sugar prices within the EU becoming more closely aligned with world prices. A report published in April 2017 for the Commonwealth Secretariat titled, *Potential for a Regional Sugar Market in CARICOM*, stated that the creation of an integrated sugar market within CARICOM with an implementation of a common external tariff (CET) (possibly 40%) on all sugar imports, is one way in which regional sugar industries can be supported in the future. The reason Caribbean sugar industries require support is that they cannot compete at world sugar prices which are extremely volatile.

The CET currently applies to raw brown sugar and refined white sugar. Because producers within CARICOM are currently unable to produce sufficient refined sugar to meet needs of mainly industrial users within the region, some member states apply nominal rates allowed under 'List A' (a mechanism for securing goods without the heavy tariff from outside of the region). Introduction of a uniform CET on refined sugar would facilitate more organized and profitable trade for sugar sold within CARICOM and encourage investment.

Securing the CARICOM Market

According to the Commonwealth Secretariat report, annual sugar production in CARICOM is 450,000 to 500,000 tonnes, which is higher than the 300,000 tonnes currently needed. However, this volume can be potentially consumed in the region when Haiti completes its integration into the Caribbean single market economy. Caribbean countries import approximately 200,000 tonnes of sugar from outside the trade bloc due to the absence of

Continued on pg 6

The Sweet and Sour...Continued from pg 5

refined white sugar production in the region. In previous years they have exported 75 to 80% of their output to the high-priced EU and US markets, overwhelmingly as raw sugar. There was not much incentive to invest in capacity to produce high quality plantation white or refined white sugar. However, meeting the regional demand is now seen as a priority; structural improvements are being made by companies and government policies to improve trade are being undertaken to achieve this objective.

In the 45th Council for Trade and Economic Development (COTED) meeting held in November 2017 in Guyana, the Belize government delegation presented its case for application of the CET of 40% on refined cane sugar. This delegation included CEO Masson and CEO Alpuche, and Director Sutherland and Sr. Economist Reid from the Directorate General for Foreign Trade. Representatives from both BSI-ASR and Santander were in attendance for the discussion on sugar. Presentations were made by BSI-ASR and also by the Sugar Association of the Caribbean (SAC). SAC and BSI highlighted an ongoing study on the likely impact of increasing the CET to 40% on all external sugar products. That analysis conveyed that for imported sugar the net price effect on consumers is an increase in the range of 1-10 USD per person annually, which is considered minimal. The average bottle of soft drink would rise by $0.06. It must be remembered that CARICOM sugar is traded duty-free and as such prices will remain the same for products utilizing regional inputs.

The case for sugar was supported by the COTED which agreed on a way forward focused on completion of the study on application of the CET to refined sugar; this study is to be reinforced by consultations with all user stakeholders and primarily with industrial users such as manufacturers of beverages and pastries. The matter is also to remain on the COTED agenda until finally resolved. Belize will remain the lead advocate, all working in coordination and collaboration with the SAC and CARICOM Secretariat.

The two tables below were sourced from UNCTAD Trademap.org database. It shows imports of BZ$ 476.7 M in 2016 while exports of BZ$ 273.1 M for regional trade on sugar. This sugar includes all types, e.g., refined white, plantation white, icing sugar, sucrose from beet and sugarcane.

Importers	2013	2014	2015	2016
World	BZ$63879032,000.00	BZ$57583148,000.00	BZ$47731836,000.00	BZ$56169238,000.00
CARICOM	BZ$491316,000.00	BZ$459440,000.00	BZ$353664,000.00	BZ$476690,000.00
Haiti	BZ$211184,000.00	BZ$216836,000.00	BZ$142232,000.00	BZ$235640,000.00
Trinidad and Tobago	BZ$94774,000.00	BZ$77580,000.00	BZ$75938,000.00	BZ$81660,000.00
Jamaica	BZ$78428,000.00	BZ$67756,000.00	BZ$64256,000.00	BZ$68308,000.00
Suriname	BZ$30366,000.00	BZ$27262,000.00	BZ$0.00	BZ$25640,000.00
Bahamas	BZ$16442,000.00	BZ$18496,000.00	BZ$19686,000.00	BZ$16990,000.00
Barbados	BZ$18904,000.00	BZ$18416,000.00	BZ$15492,000.00	BZ$16738,000.00
Guyana	BZ$12990,000.00	BZ$8854,000.00	BZ$12756,000.00	BZ$9596,000.00
Saint Vincent	BZ$6272,000.00	BZ$5124,000.00	BZ$5394,000.00	BZ$4680,000.00
Saint Lucia	BZ$9828,000.00	BZ$7596,000.00	BZ$6494,000.00	BZ$4288,000.00
Grenada	BZ$1992,000.00	BZ$3118,000.00	BZ$3884,000.00	BZ$3554,000.00
Antigua and Barbuda	BZ$3240,000.00	BZ$3042,000.00	BZ$2122,000.00	BZ$2880,000.00
Dominica	BZ$3628,000.00	BZ$1632,000.00	BZ$3070,000.00	BZ$2812,000.00
Belize	BZ$324,000.00	BZ$836,000.00	BZ$752,000.00	BZ$2004,000.00
Saint Kitts and Nevis	BZ$2736,000.00	BZ$2632,000.00	BZ$1488,000.00	BZ$1808,000.00
Montserrat	BZ$208,000.00	BZ$260,000.00	BZ$100,000.00	BZ$92,000.00

Exporters	2013	2014	2015	2016
World	BZ$64571396,000	BZ$54181568,000	BZ$45983404,000	BZ$54251490,000
CARICOM Member states	BZ$459148,000	BZ$307180,000	BZ$379094,000	BZ$273108,000
Guyana	BZ$228374,000	BZ$175502,000	BZ$223496,000	BZ$141022,000
Belize	BZ$107356,000	BZ$110190,000	BZ$134324,000	BZ$102878,000
Jamaica	BZ$105430,000	BZ$120,000	BZ$11294,000	BZ$20190,000
Barbados	BZ$15950,000	BZ$17746,000	BZ$7278,000	BZ$7100,000
Trinidad and Tobago	BZ$1912,000	BZ$3218,000	BZ$2510,000	BZ$1788,000
Suriname	BZ$64,000	BZ$244,000	BZ$0	BZ$112,000
Saint Lucia	BZ$48,000	BZ$44,000	BZ$24,000	BZ$18,000
Antigua and Barbuda	BZ$0	BZ$90,000	BZ$0	BZ$0
Bahamas	BZ$0	BZ$2,000	BZ$0	BZ$0
Haiti	BZ$0	BZ$0	BZ$2,000	BZ$0
Saint Kitts and Nevis	BZ$14,000	BZ$22,000	BZ$0	BZ$0
Dominica	BZ$0	BZ$2,000	BZ$0	BZ$0
Grenada	BZ$0	BZ$0	BZ$166,000	BZ$0

SPANISH LOOKOUT COMMUNITY STATISTICS 2017

			End of 2017	End of 2016	End of 2015	End of 2014	End of 2013	End of 2012	End of 2005
Dairy Cattle			1,556	1,507	1,480	1,309	1,376	1,357	1,293
Beef Cattle			17,111	15,506	14,703	13,574	13,299	13,169	10,140
	On	Out	Total	Total	Total	Total	Total	Total	Total
Acres corn planted Summer	15,943	8,152	24,095	28,588	25,052	22,697	23,365	20,082	12,509
Acres corn planted Winter	1,453	1,726	3,179	3,291	2,930	180	2,209	798	574
Acres milo planted Summer	0	0	0	40	10	8	8	54	213
Acres milo planted Winter	739.5	1225	1964.5	3647	735	179	2498.5	3339	104
Acres R.K. beans planted	2,759	347	3,106	4,097	6,553	6,632	5,594	3,677	3,194
Acres B.E. peas planted	2,087	985	3,072	6,650	5,385	5,008	5,592	6,096	5,091
Acres Soy Beans Planted	4,129	4,369	8,498	3,343	3,771	1,444	3,051	922	215
Acres rice planted	1446	2088	3534	2867	2500	4335	5211.5	2948	215
Acres other crops planted	736	400	1,136	951	997	691	1,228	663	1,013
Bags corn harvested Summer	721,294	396,953	1,118,247	736,254	878,300	1,243,675	1,027,755	865,726	406,324
Bags corn harvested Winter	32,214	41,330	73,544	83,274	30,671	3,653	63,245	16,590	17,465
Bags white corn harvested Sun	30375	9200	39575	41882	48940	112240	17198	59293	4211
Bags milo harvested Summer	0	0	0	360	37	50	50	571	4,211
Bags milo harvested Winter	18,402	40,923	59,325	106,168	20,344	4,977	67,879	84,904	0
Bags R.K. beans harvested	26,485	3,514	29,999	36,772	51,508	34,886	37,854	26,784	30,850
Bags B.E. peas harvested	20210	12102	32312	79953	54488	41186	54360	46645	50490
Bags Soy Beans Harvested	67,179	70,377	137,556	53,770	54,907	16,262	44,936	16,191	4,921
Bags rice harvested	70,746	60,248	130,994	82,789	96,189	178,502	139,785	102,546	2,778
Bags other crops harvested	5,752	4,343	10,095	9,224	4,648	3,470	9,746	4,167	

BEYOND THE BACKYARD

Singing its Praises

By Jenny Wildman

Driving from north to south one can find tall droopy berry trees following the paths of our inhabitants.

Considering that the berry tree grows so profusely it is surprising that there is very little information on its taxonomy and uses. In fact, even its name is in question as there are plants of similarity and several varieties within that species. Perhaps we can pull them out of the woodwork and take a closer look.

Many years ago whilst discussing the importance of antioxidants and anthocyanins (natural plant pigments imparting red, blue, and purple colors to flowers, leaves, fruits, and some vegetables of proven health benefit) with Dr. Bernard Bulwer in Belize City, I said, "Well unfortunately we do not have berries here for that." He jumped up enthusiastically saying, "Yes we have the **blackberry**." Porting a tarpaulin he took me outside to shake the tree laden with rich-looking fruits, meanwhile touting their powerful health benefits. Although I had tasted homemade blackberry wine and jam in Corozal, I had never connected them to this tree.

The other day I stopped at Sandhill, sampled some fare and bought delicious blackberry wine from Vince McKesey, made from the fruit of the tree he calls "jamun". This is one local name for the jambolan, Java plum, Malabar plum, duhat or *Syzygium cumini* which was transported from India to many British colonies and used for producing a popular alcoholic beverage, particularly for a bit of Christmas cheer. However so did the rumberry and guavaberry *(Eugenia floribunda)*, also referred to as the blackberry growing throughout Belize. Traditionally Christmas carolers in the Caribbean went door to door and took a little libation with their friends. The Virgin Islands once had a lucrative trade, principally with Denmark, of liqueur made from the *Eugenia* tree. Nowadays it can be found only if you visit the islands such as Saint Martin (Sint Maarten) which is known for its guavaberry rum and liqueur. At Christmas throughout the Caribbean, songs proclaim the love of berry wine. "Drinking my guavaberry watching the sun go down, Oh woman that's all I need" and here in Creole, "Drink yu wine on a Krismas mawnin, drink yu wine." I am sure there are many more lyrics and whichever the berry the outcome is the same to enjoy.

Both berry trees are in the family Myrtacaeae which has many members and both can produce several thousand fruits on a single tree. Yet a berry is by botanical definition, a juicy soft fruit, sweet or sour with pips whose fruit is produced from a single flower. Interestingly, true examples of those are tomatoes, grapes and bananas! A plum is of the genus *Prunus*. So although our beloved jambu has a soft fleshy translucent interior with a single stone it is neither a plum nor a berry; it is a drupe.

Both "blackberry" trees have been grown largely for medicinal purposes for diabetes and digestive complaints and are rich in vitamin C and antioxidants. Other uses such as for wood have not gained much interest. In India the significance is seen in marriage ceremonies where leaves are also used for decoration. Lord Krishna carries symbols of the jambu on his right foot and both the fruit and seed are used in traditional Ayurvedic medicine. For people living in the country off the land this free fruit can be a great source of vitamins for the family. It is recognized as an important food for animals, bats, birds and bees but deserves a little more respect again from humans. Unfortunately in the commercial world *taste* sells better than *benefit* so most trees never get harvested and leave behind a purple carpet to rot and mulch the ground with lost nutrients. As the tree very easily grows wild it is also considered in some places to be invasive. The taste of blackberries is somewhat acrid, bitter sweet with a powdery after taste which benefits from soaking in salt or sugar. Blackberries are great for rum mixes, syrup, vinegar, pickles, kombucha, cocktails, jams, and pies.

Embrace our culture and keep the blackberry tradition alive. As Gordon Lightfoot sang.....

"I am bent but not broken, all I need is my share
Of a bottle of that very rare Blackberry Wine"

For recipes and information you would like to share please email: jenniferjanewildman@gmail.com

SOS: Save our Soils

Dr. Christine Jones Explains the Life-Giving Link Between Carbon and Healthy Topsoil

Interviewed by Tracy Frisch

Reprinted from ACRES USA The Voice of Eco-Agriculture March 2015 • Vol. 45, No. 3

Dr. Christine Jones

To the pressing worldwide challenge of restoring soil carbon and rebuilding topsoil, the Australian soil ecologist Dr. Christine Jones offers an accessible, revolutionary perspective for improving landscape health and farm productivity. For several decades Jones has helped innovative farmers and ranchers implement regenerative agricultural systems that provide remarkable benefits for biodiversity, carbon sequestration, nutrient cycling, water management and productivity. After a highly respected career in public sector research and extension, in 2001 Jones received a Community Fellowship Award from Land and Water Australia for "mobilizing the community to better manage their land, water and vegetation." Three years later she launched Amazing Carbon as a means to widely share her vision and inspire change. Jones has organized and presented workshops, field days, seminars and conferences throughout Australia, New Zealand, South Africa, Zimbabwe, Europe, the United States and Canada. Last year, she gave presentations to American organizations and institutions as diverse as Arizona State University, NRCS, Pennsylvania No-Till Alliance, the Massachusetts chapter of Northeast Organic Farming Association (NOFA), San Luis Valley Soil Health Group and the Quivira Coalition. In 2015 Jones' personal commitment to make the biggest possible impact globally will take her to Alberta, Saskatchewan, Manitoba, Ontario, Kansas, New Mexico, California, Florida, Costa Rica and South Africa, as well as many regions within Australia and New Zealand. In early March she travels to Western Australia, 2,500 miles from her home, to hold the first in a series of Soil Restoration Farming Forums, in which 11 farmers will receive monetary awards for reversing soil deterioration in dryland cropping systems through intercropping with perennial warm season grasses.

ACRES U.S.A. You've written that the most meaningful indicator for the health of the land and the long-term wealth of a nation is whether soil is being formed or lost. Yet there's a widespread belief, actually dogma, that the formation of soil is an exceedingly slow process. Even some organic researchers accept that idea. You describe the formation of topsoil as being breathtakingly rapid.

DR. CHRISTINE JONES. People have confused the weathering of rock, which is a very, very slow process, with the building of topsoil, which is altogether different. Most of the ingredients for new topsoil come from the atmosphere — carbon, hydrogen, oxygen and nitrogen.

ACRES U.S.A. Why have many soil scientists denied the phenomenon of rapid soil-building?

JONES. Because they do their research in places where it's not happening, where the carbon is running down and the soils are deteriorating. We need to measure carbon on farms where soil-building is occurring and see what the farmers and ranchers are doing to make that happen.

ACRES U.S.A. The process of fixing carbon in the soil seems to be the crux of your work. You describe a cycle with carbon in three phases: as a gas, a liquid and a solid.

JONES. The issue we're facing is that too much of the carbon that was once in a solid phase in the soil has become a gas. That could be dangerous for the human species. Climate change is just one aspect. Food security, the nutrient density of food and the water-holding capacity of the soil are also very potent reasons for keeping carbon in a solid phase in the soil.

ACRES U.S.A. Your term "liquid carbon" is such a brilliant phrase. It has really helped me conceptualize the carbon cycle. What do you mean by it?

JONES. Liquid carbon is basically dissolved sugar. Sugars are formed in plant chloroplasts during photosynthesis. Some of the sugars are used for growth and some are exuded into soil by plant roots to support the microbes involved in nutrient acquisition.

ACRES U.S.A. I remember bringing up the idea of leaky roots in a conversation with you and you laughed.

JONES. At first people thought "leaky" roots were defective. Exuding carbon into the soil seemed such a silly thing for plants to do! Then it became recognized that some of the exudates were phenolic compounds with allelopathic effects, important in plant defense. Of course we now know that plant roots exude a vast array of chemical substances, all based on carbon, to signal to microbes and to other plants. But perhaps the most significant finding, at least from a human perspective, is that the flow of liquid carbon to soil is the primary pathway by which new topsoil is formed.

ACRES U.S.A. All of which revolves around the concept of a plant-microbial bridge?

JONES. In order for carbon to "flow" to soil, there has to be a partnership between plant roots and the soil microbes that will receive that carbon. Somewhere between 85 to 90 percent of the nutrients plants require for healthy growth are acquired via carbon exchange, that is, where plant root exudates provide energy to microbes in order to obtain minerals and trace elements otherwise unavailable. We inadvertently blow the microbial bridge in conventional farming with high rates of synthetic fertilizers or with fungicides or other biocides.

ACRES U.S.A. Are you observing an increased awareness of the significance of biological processes?

JONES. There is a lot more energy generated through biological processes than through the burning of fossil fuels. Most life-forms obtain their energy either directly or indirectly from the sun, via the process of photosynthesis. Plants are what we call autotrophs. That is, they feed themselves by combining light energy with CO_2 to produce biochemical energy. As heterotrophs, we obtain energy by eating plants or eating animals that ate plants. In effect, we're running on light energy too. Even microbes in a compost heap are obtaining energy by breaking down organic materials originating from the process of photosynthesis.

ACRES U.S.A. You distinguish between organic matter formed by the decomposition of manure, crop residues or other carbonaceous materials — and humus — which is generated via a building-up process. I think a lot of times that is misunderstood.

JONES. It's a really important distinction, but it's often overlooked. In order to obtain the energy that is contained in cellulose, lignin, starches, oils, waxes or other compounds formed by plants, microbes have to break this material down — the same as we do when we digest starches or proteins or anything else of plant or animal origin. We breathe out more CO_2 than we breathe in, because as we utilize the energy we obtain from the assimilation of food, our cells release CO_2. The decomposers in the soil are doing exactly the same thing — breaking down organic materials and releasing CO_2. These processes are catabolic. Conversely, the formation of humus is an anabolic process, that is, a building-up process. Rather than sugar being the end point, sugar is the start point. Soil microbes use sugars to create complex, stable forms of carbon, including humus.

ACRES U.S.A. How would you define humus?

JONES. Humus is an organo-mineral complex comprising around 60 percent carbon, between 6 and 8 percent nitrogen, plus phosphorus and sulfur. Humic molecules are linked to iron and aluminum and many other soil minerals, forming an intrinsic part of the soil matrix. Humus cannot be "extracted" from soil any more than wood can be "extracted" from a tree.

Continued on pg 15

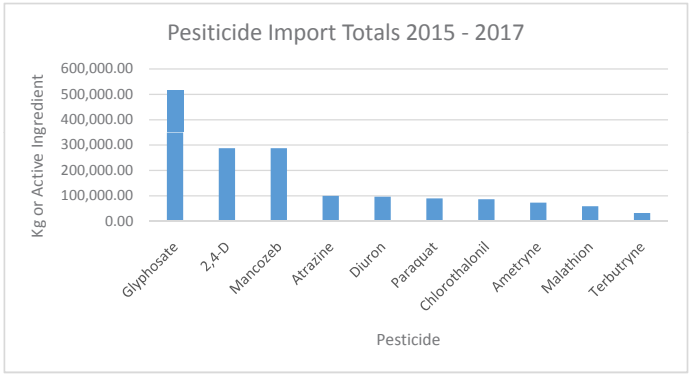
Pesticide Import Data 2015 to 2017

Total Kilograms of Active Ingredient Imported by Year

2015	**1,108,693.59**
2016	**1,010,027.67**
2017	**1,215,860.00**

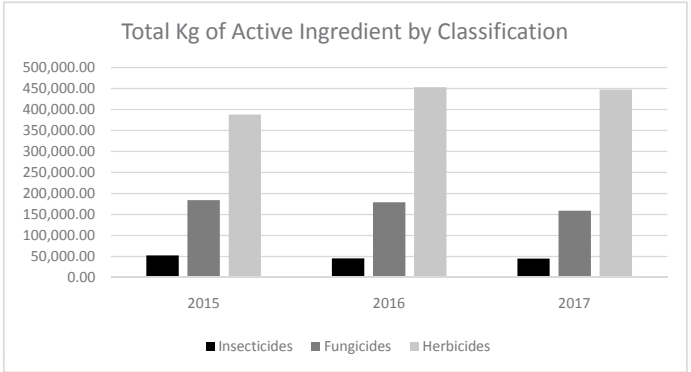
Top ten most imported pesticide for 2015 to 2017
Pesiticide Kg of Active Ingredient

Common Name	Kg of A.I.
Glyphosate	516,954.77
2,4-D	288,167.82
Mancozeb	287,894.44
Atrazine	99,949.18
Diuron	96,797.20
Paraquat	90,017.60
Chlorothalonil	86,446.08
Ametryne	73,621.20
Malathion	59,660.80
Terbutryne	32,662.00



Total Kg of Active Ingredient by Classification

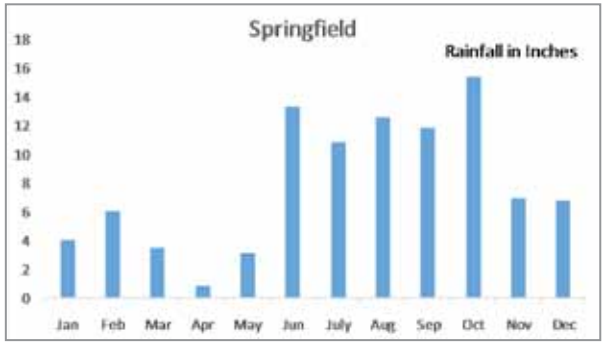
	2015	2016	2017
Insecticides	52,670.79	45,328.10	44,682.73
Fungicides	184,093.30	179,267.52	158,942.36
Herbicides	387,825.16	453,026.90	447,617.64



Rainfall - Springfield Community

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

2017	Inches
Jan	4.1
Feb	6.1
Mar	3.5
Apr	0.9
May	3.2
Jun	13.4
July	10.9
Aug	12.6
Sep	11.9
Oct	15.5
Nov	7
Dec	6.8
total	95.9

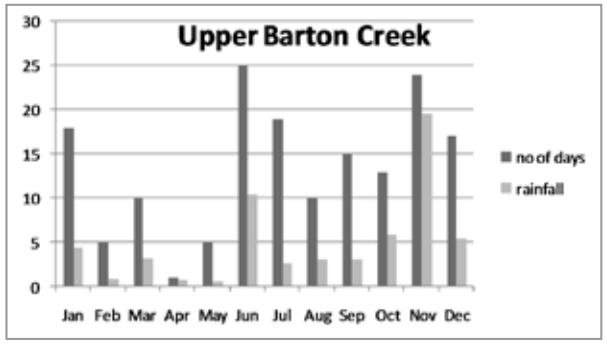


Rainfall - Upper Barton Creek

Rainfall records have been kept for 24 years. The average annual rainfall is 75.56". The highest annual rainfall, 101.1", was in 2006. The lowest annual rainfall, 52.8" was in 1994.

We thank, Mr. Isaak Harder and Upper Barton Creek Community for sharing this data.

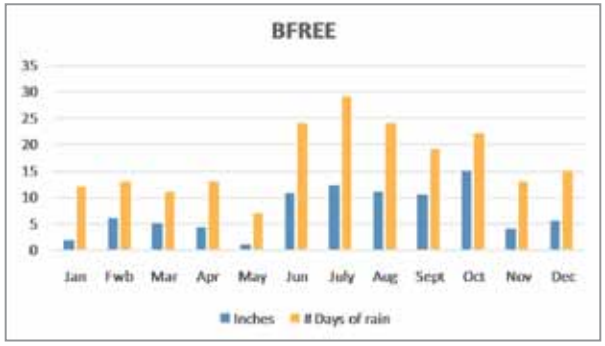
2017	No. of days	Inches
Jan	18	4.43
Feb	5	0.93
Mar	10	3.21
Apr	1	0.7
May	5	0.53
Jun	25	10.4
Jul	19	2.58
Aug	10	3.11
Sep	15	3.13
Oct	13	5.93
Nov	24	19.57
Dec	17	5.45
Total	162	59.97



Rainfall - BFREE

The Belize Foundation for Research and Environmental Education (BFREE) has been collecting rainfall data for several years. We thank Ms. Heather Barrettt, their Deputy Director for sharing their data.

2017	No. of days	Inches
Jan	12	1.766
Fwb	13	5.94
Mar	11	5.08
Apr	13	4.33
May	7	0.901
Jun	24	10.614
July	29	12.141
Aug	24	10.97
Sept	19	10.501
Oct	22	14.855
Nov	13	3.924
Dec	15	5.389
TOTAL	202	86.411



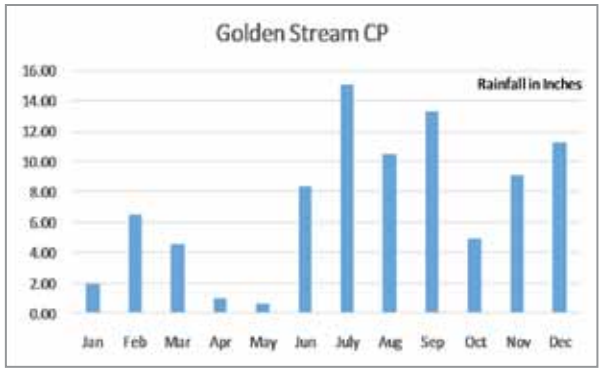
Although the trend of lower rainfall in northern Belize, and higher rainfall in the south still remains generally true, much variation can be seen within each area.

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

Rainfall - Ya'axché Golden Stream Corridor Preserve

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

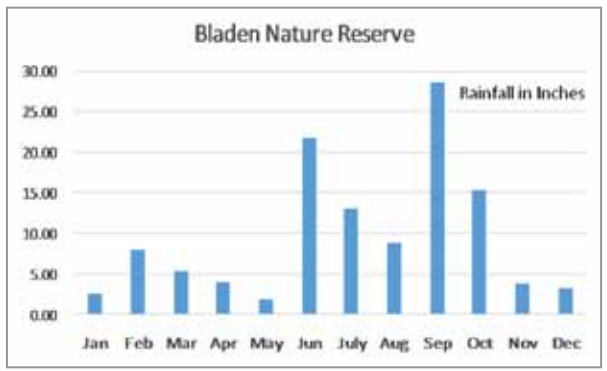
2017	inches	mm
Jan	1.92	49.20
Feb	6.55	168.01
Mar	4.56	116.80
Apr	1.04	26.64
May	0.67	17.24
Jun	8.37	214.49
July	15.09	387.00
Aug	10.49	268.85
Sep	13.26	340.10
Oct	4.96	127.19
Nov	9.13	234.01
Dec	11.28	289.31
Total	87.31	2238.84

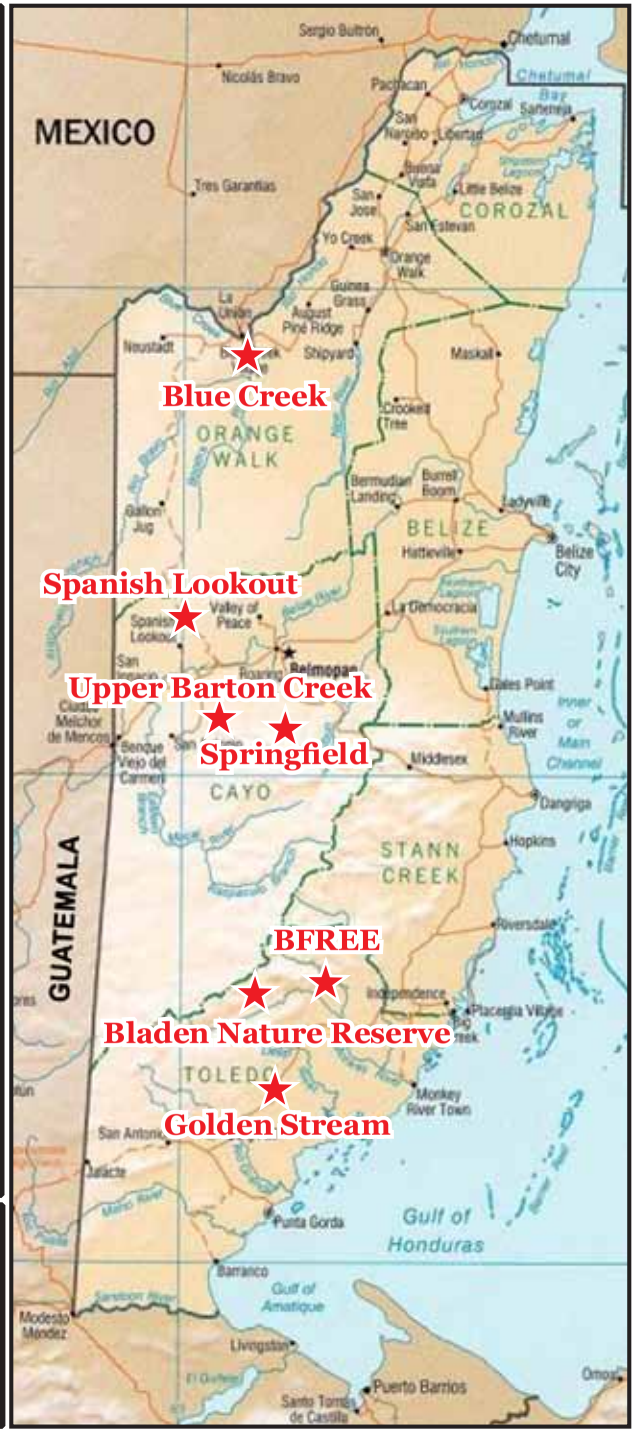


Rainfall - Ya'axché Bladen Nature Reserve

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

2017	inches	mm
Jan	2.61	66.80
Feb	8.09	207.52
Mar	5.46	139.95
Apr	4.05	103.89
May	1.97	50.55
Jun	21.74	557.53
July	13.12	336.30
Aug	8.95	229.36
Sep	28.57	732.54
Oct	15.33	393.19
Nov	3.83	98.30
Dec	3.25	83.31
Total	116.97	2999.24



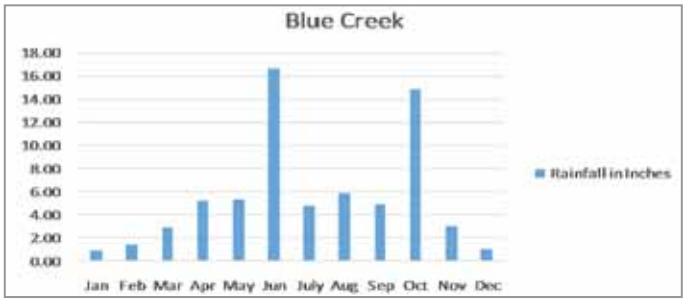


2017 Rain Data for Spanish Lookout and Blue Creek on page 14

Rainfall - Blue Creek

Rainfall records have been kept in Blue Creek for 24 years. The highest annual rainfall of 84.3" was in 2012. The lowest annual rainfall of 42.8" was in 1998. We thank Mr. Peter B. Rempel for sharing this data.

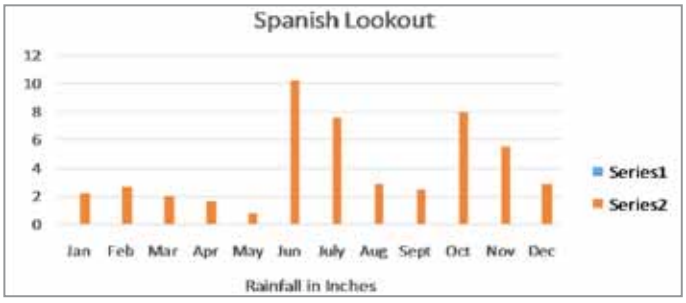
2017	Inches
Jan	0.90
Feb	1.50
Mar	2.90
Apr	5.20
May	5.30
Jun	16.60
July	4.80
Aug	5.90
Sep	4.90
Oct	14.90
Nov	3.00
Dec	1.00
Total:	66.90



Rainfall - Spanish Lookout

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

2017	Inches
Jan	2.15
Feb	2.69
Mar	1.99
Apr	1.64
May	0.80
Jun	10.22
July	7.53
Aug	2.84
Sept	2.42
Oct	7.93
Nov	5.49
Dec	2.88
Total	48.58



Save our Soils...Continued from pg 9

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ACRES U.S.A. You frequently mention mycorrhizal fungi in your work. What makes them so special?

JONES. Much of the initial research into mycorrhizal fungi was related to the uptake of phosphorus. Phosphorus is a highly reactive element. As soon as there's any free phosphorus floating around in the soil, including whatever we may add as fertilizer, it becomes fixed. In other words, it forms a chemical bond with another element like iron or aluminum or calcium, making it unavailable to plants. But certain bacteria produce an enzyme called phosphatase that can break that bond and release the phosphorus. Once released, the phosphorus still has to be transported back to the plant, which is where mycorrhizal fungi come in. As our analytical techniques have became more sophisticated, we've realized that mycorrhizal fungi also transport a wide variety of other nutrients, including nitrogen, sulfur, potassium, calcium, magnesium, iron and essential trace elements such as zinc, boron, manganese and copper. In dry times they supply water. Mycorrhizal fungi can extend quite a distance from plant roots. They form networks between plants and colonies of soil bacteria. Plants can communicate with each other via messages sent through these networks. Mycorrhizal fungi are both the highway and the Internet of the soil.

ACRES U.S.A. How can something so important be overlooked?

JONES. Much of the agricultural research undertaken in pots in glass houses is fundamentally flawed. Soil is homogenized to remove background noise, that is, to make the soil in all the pots similar at the outset. The blending process breaks up the hyphae of mycorrhizal fungi. In some trials the soil is also sterilized to eliminate any microbial activity that could interfere with the treatment being assessed. And often the soil has been stored for a long time prior to the experiments, which means most of the soil organisms have died. In such an environment, plants are likely to respond to applied fertilizer, as they have no other means to obtain nutrients. Similarly with field trials, if the soil has been cultivated or bare fallowed, mycorrhizal fungi will not be there in sufficient quantities for effective carbon flow and nutrient acquisition. In healthy, biologically active soils, we do not see a response to synthetic nitrogen or phosphorus fertilizers. If anything, the use of these is counterproductive.

ACRES U.S.A. I've learned from you that plants colonized by mycorrhizal fungi can grow much more robustly even though they're giving away as much as half of the sugars that they make in photosynthesis through their roots.

JONES. That's correct.

ACRES U.S.A. So we have this system characterized by abundance and generosity, and that's really different from the way we are used to thinking about growing crops.

JONES. The point that's often missed is that a mycorrhizal plant photosynthesizes much faster than a non-mycorrhizal plant of the same species growing right next to it. The plant is able to give half its energy away and still grow stronger because of the symbiotic relationship with the fungus. It doesn't cost the plant anything to photosynthesize faster. It's just using sunlight more efficiently. Remember, plants are autotrophic.

ACRES U.S.A. And sunlight is free.

JONES. CO_2 is free too. If a plant photosynthesizes faster it's going to have higher sugar content and a higher Brix level. Once Brix gets over 12, the plant is largely resistant to insects and pathogens. High-Brix plants have formed relationships with soil microbes able to supply trace elements and other nutrients that the plant needs for self-defense, for its immune system. When plants are able to produce high levels of plant-protection compounds, the insects go elsewhere.

ACRES U.S.A. We tend to think that minerals in the soil are scarce because most of them are not in a form available to plants.

JONES. A soil test will only tell you what is available to plants by passive uptake. The other 97 percent of minerals — made available by microbes — will not show up on a standard test. By looking after the microbes in the soil we can increase the availability of a huge variety of minerals and trace elements — most of which are not even in fertilizers.

ACRES U.S.A. We always hear the story about fields that were continuously cropped or hayed for 30 years where the soil is so exhausted that we have to add a lot of nutrients or we can't grow a thing.

JONES. The problem is that we interrupt carbon flow with the way we farm. Cultivating the soil and using chemical fertilizer and pesticides break up the mycorrhizal networks. If plants can obtain nitrogen or phosphorus easily, they will stop pumping carbon into the soil to support their microbial partners. It's taken a while for people to realize that plant root exudates are not only important for nutrient exchange, but also essential for the maintenance of topsoil. If carbon is not flowing to soil via the liquid carbon pathway, soil deteriorates. Carbon is needed for soil structure and water-holding capacity as well as for feeding the microbes involved in nutrient acquisition. When soil loses carbon, it becomes hard and compacted. The differences in infiltration and moisture retention between high-and low-carbon soils are dramatic. Planetary stocks of fresh water are declining alarmingly. More efficient water use is going to be absolutely critical to the survival of our species. Making better use of water requires improved soil structure — which in turn requires actively aggregating soils. If aggregates are breaking down faster than they're forming, the water-holding capacity of soil can only deteriorate.

ACRES U.S.A. How can we tell if a soil has good aggregation?

JONES. Dig a hole and take a handful of soil. Squeeze it gently and release. If the soil is well aggregated, it will look like a handful of peas. If the soil remains in hard chunks that don't break easily into small lumps, then it isn't well aggregated.

ACRES U.S.A. What processes are going on inside of a soil aggregate?

Continued on pg 23

Preparing Soil Fertility for New Plantings of Deep Rooted Crops

By Neal Kinsey

Preparing new soil for planting can make significant differences in plant growth – some good and some bad - depending on several important, but too often overlooked, considerations.

In the 1950's and 60's students in soil science were being taught that the soil was just there to hold up the plants. Once during a seventh grade agriculture class in the 1950's it was stressed by our teacher that farmers were then being advised that it was a waste of time to clean out the barns and spread manure anymore. The cost to remove and spread it in comparison to buying it from the fertilizer dealer was far too expensive. The solution was then provided as applying enough lime and commercial fertilizer to grow the plants based on the appropriate proven yield average for the area. It may be dressed up in one way or another, but taken as a whole, those whose goal is only to sell fertilizer generally use some type of "feed the plant" program. Too many who offer advice about what fertilizers to use have never been taught to understand any other way!

One serious mistake that too many farmers and growers make is trying to formulate one fertilizer mix that will work for the entire planting, even when there are very obvious differences. Even on "flat ground" in areas where there is enough rain for water movement in one specific direction there is generally a sufficient enough change in nutrient values to sample the lower portion (where water runs to) and the higher portion (where water runs from) and treat them according to their different needs. *(Guidelines on how to properly take a soil test is available from our web site, www.kinseyag.com, or sent free upon request.)*

Especially as new plants are being established, the emphasis should be on what the soil specifically needs to support new growth. And where maximized quality or high production is the goal, this becomes even more important. The problem is, most who advise on fertility have not studied how to correct the soil itself to supply the nutrients. Instead a "feed the plant" approach is used, because that is generally all that has been taught in terms of fertilization over the past few decades.

This concept has now been accepted as the standard way to fertilize soil for so long that many have the idea that this is the only way to survive in agriculture. And that statement is 100% correct. But it is the wrong approach. The goal for all types of growers should not be how to survive in agriculture. The goal for growers needs to be how to thrive, not how to survive. Feed the soil the nutrients it needs to thrive and the plants will thrive as well, and so will those who practice such principles correctly. As growers of all types of crops and plants learn what it takes to successfully apply such principles, then it becomes clear that taking care of the soil is the real key to the greatest successes in agriculture.

Another problem that becomes evident, especially when working with those growing tree and vine crops, is that many adopt the practice of probing far too deeply when taking soil samples. Due to the fact that roots penetrate deeply into the soil, too many growers take their soil samples twelve inches deep. The question to consider under such circumstances is that even if needed nutrients are lacking, how do you apply them correctly and get them down to that level?

When considering how to build soil fertility, the most important zone to consider is the aerobic zone - the top 6 to 7 inches. This is the part of the soil that contains microorganisms that can only operate properly when adequate oxygen is present.

The only exception to sampling the aerobic zone - roughly considered as 6 ¾ inches deep because an acre of soil down to that depth will generally weigh about 2 million pounds - is when all materials must be placed on top of the soil and will not be worked into the top 2 inches or more. In such circumstances take the topsoil sample from only the first 4 inches of soil in order to avoid possibly overstating the need for one or more of the nutrients required to properly supply the soil in question. This is true not just for those using no-till methods, but for every grape vineyard, every orchard, every pasture, golf course, lawn and even landscape plantings.

Establishing the correct depth to sample should be the first consideration when sampling any soil. This is an extremely important step to provide the correct information for establishing the present needs for correcting the fertility level of each soil. Too many disregard this requirement because they forget that the excessive concentration of any one nutrient added to the soil causes a deficiency of some other needed nutrient.

For example, too much phosphate ties up zinc. Too much nitrogen ties up copper. Too much potassium ties up boron and when extremely excessive it also blocks manganese uptake. And too much of any one of the various liming materials ties up at least a portion of just about all the elements we can measure with a soil test, with phosphate usually being the exception. Thus, when liming is done, borderline levels in a soil are reduced even further and may then drop into the deficiency category. Such problems should initially be evident and established by use of an accurate soil test.

The soil is the plant's stomach! It is the area where nutrients are most available because the microbial activity is greatest there. Because of this, think of the aerobic zone as the most important consideration for soil testing. Even more, track this area separately because, invariably, every plant feeds in the aerobic zone.

The depth to which soil sampling should be done after considering the aerobic zone depends on the circumstances and the way each farmer or grower intends to use the information gained. If some type of subsoiler or deep ripper will be pulled through to a depth of 5 feet, it will likely be of benefit to learn what is down there first. But once you know what is there, how can you affect fertility levels there to push them higher or lower? Essentially, at that depth, you have only what you have to work with and not much chance of affecting it on a short term basis except to break up any hardpan and allow roots and moisture to penetrate more easily so as to better utilize what is there.

A major key to effective fertilization is the use of soil samples to measure what nutrients are present as deeply as the roots may have a tendency to penetrate. But utilize testing and fertilization of the topsoil first; then, if desired, sample the deeper subsoil levels to prove or disprove what changes are thought to be possible there. (It is possible to apply fertilizer or soil amendments to the soil surface and significantly increase the nutrient values at two to three feet deep over a period of seven to ten years. This has been proven by clients on their own land using treated vs. control areas, properly sampled beforehand and through the years.)

Next determine how deep you have the ability to work the soil and the efficiency of the equipment used to mix the applied materials with the soil. The key is to achieve a homogeneous mix. Use the rule of thumb that adequate mixing of the nutrients being applied is satisfactory to only half the depth the equipment is able to thoroughly mix the soil.

Keep in mind that thorough mixing is of the utmost importance. When nutrient material is applied in clumps, if it is something the plant requires, roots concentrate there. In such cases again consider the "law of the maximum" – excess P ties up zinc, etc. Would the contents of the clump cause toxicity problems for roots that would normally penetrate that area? Better to be safe than sorry!

Perhaps an example will help to make this principle easier to understand. A potato farmer was having a problem with his vines. Once planted the potatoes would all come up and grow off well. But then suddenly, all the vines would fall over resulting in scald damage from the hot sun to the plants. Then eventually the plants would straighten back up and grow as they should, but always had the scalding evident from the time when they had fallen over. The concern was that the damage caused to the stalk was affecting the yield. Testing had been done on some fields and sent for analysis and recommendations. The problems still kept happening on those fields.

The company scheduled a field consultation to the site. With recommendations in hand we walked into the fields to see what could be learned. The recommendations were to broadcast needed potassium, but the fertility program had always been to apply the potassium directly under the row. The theory was that potato roots stayed very close to the row and did not spread well.

In this case, the potassium was building up so high in the soil just below the potatoes that it was causing the problem. As the plants began to grow they did well. But when the roots reached the heavy application of potassium it was too much. Such a high potassium concentration always interferes with manganese uptake. Potassium is the first key to stalk strength, but manganese is also needed for strong stalks. When the K blocked the Mn, the potato stalks became weakened and fell over. Then once enough roots grew out of the zone that had the excess of potassium, there was sufficient uptake of manganese again and the vines straightened back up.

It is always important to assure there is enough fertility to grow the crop. The greatest need is in the aerobic zone – as deep as a fencepost rots down into the soil. That will be as deep as there is sufficient air for the microbes to properly do their job. Get that area supplied with adequate nutrients first. Then once this is accomplished, seeing what more is possible will be considered in another article on this subject.

Neal Kinsey's Next Belize Course September 3rd - 6th, Page 36

Coconut: Main Deficiencies And Recommended Corrections

CARDI Belize Coconut Project Team

Modified from E. Ramkhelawan and C. Paul, 2016
Coconut Production Technology; International Trade Centre; Geneva, Switzerland

Fertilizing coconut (*Cocos nucifera* L.) is not a common practice in Belize. However as a long term crop, coconuts in production can greatly deplete the nutrients around it which can lead to weakened plant health and reduced productivity. Ideally a soil analysis should be carried out before establishing the plantation so the recommended correction can be applied. Analysis should be repeated every other year to determine the soil nutrition status and implement corrections. Coconut nutrient imbalances can take as long as three years to correct; therefore proper nutrition is essential to mitigate these occurrences. Timely application of fertilizers can also increase nut and copra yield by as much as 230%.

Nutrient deficiency can be diagnosed through soil testing, visual symptoms and foliar diagnosis. Nutrition deficiencies in coconuts may be as a result of a high soil pH, reduced aeration in the soil, nutrient imbalances and deep planting. Some of the major nutrition issues and amelioration practices are:

Macronutrient deficiencies

Element	Early symptoms	Late symptoms	Recommended correction
Nitrogen - N is a key nutrient for vegetative growth and rapid development.	N deficiency is observed as uniform light green to yellow older leaves (chlorosis) beginning from the tip and progressing to the base of lower leaves. 	 This phenomenon proceeds to the upper whorls as the deficiency progresses and younger leaves turn golden yellow. Growth is stunted and the palms eventually shed the leaves.	To correct N deficiency apply foliar application of 2% urea (46-0-0) at 15-day intervals or soil application of 1.0 kg urea per tree.
Phosphorous: P is important for cell division. It is also important for root growth.	P deficiency occurs in acid and alkaline soils. Symptoms of this deficiency are purple coloration of the leaves. Leaves turn yellow before drying prematurely. 	Other symptoms are reduced plant growth, leaves remain upright and are shed prematurely. The size and numbers of leaves are also reduced. 	- To correct P deficiency use a foliar application at 15 day intervals of diammonium phosphate (DAP) (18-46-0) at 2% for acid soils, or monoammonium phosphate (MAP) (10-50-0) at 2% for calcareous soils. - Soil application of farm manure at the rate of 5 kg per palm may also be used.
Potassium: K together with P play a role in water regulation in the palm especially during dry periods and root development and the formation of sugar, fat, fibrous material.	The symptoms are present on the older leaves and spreads onwards to the younger leaves. Clear yellow or orange spots develop on leaflets with yellowing of the leaf margin. Curling of the tips and necrotic spots are found on the older leaves. 	The leaflets with the necrotic margins wither and the palm appears yellow and the trunk becomes slender with few short leaves.	To correct K deficiency broadcast an 8-2-12+4Mg fertilizer at a rate of 1 kg per 13.7 m^2 of canopy area every 3 months. This may take up to 3 years to correct.
Micronutrients are also important for proper growth and development			
Boron	One of the earliest symptoms of boron deficiency in coconut palm is leaf wrinkling, which is manifested as sharply-bent leaflet tips, commonly called "hook leaf". Leaves have a serrated zigzag appearance. Symptoms always occur on newly emerging leaves, and remain visible on these leaves as they mature and are replaced by younger leaves. Another common symptom is the failure of newly emerging spear leaves to open normally.	At a chronic stage, multiple unopened spear leaves may be visible at the apex of the canopy. Boron deficiency also occurs in inflorescence and nuts which become necrotic.  Crumpled new leaves ("accordion-leaf") on *Heterospatheelata* caused by severe B deficiency. Photo by T.K. Broschat.	Apply **For nursery** borax/sodium tetra borate 0.2% (2 g/l of water) at arate of 75 - 100 ml per seedling **For field** borax/sodium tetra borate 0.2% (2 g/l of water) at a rate of 30-50 g per adult tree once every 2 years.

Macronutrient deficiencies			
Element	**Early symptoms**	**Late symptoms**	**Recommended correction**
Manganese	 Photoby: Tim Broschat, University of Florida, Bugwood.org cc license In manganese (Mn) deficient palms, growth slows down considerably. New leaves appear chlorotic with longitudinal necrotic streaks. Newly emerging leaflets appear necrotic and withered, except the basal portion of the leaflets.	A frizzled appearance is observed as a result of the leaflet curling around the rachis. A high soil pH reduces Mn availability and symptoms may be confused with potassium and iron deficiencies.	Apply MnSO4 at a rate of 10 kg per acre.
Iron	Leaf chlorosis (yellowing) between veins of new leaves is symptomatic of iron deficiency. 	As deficiency continues, there is a uniform chlorosis of new leaves. There is also reduced leaf size with necrotic tips.	Apply $FeSO_4$ at a rate of 0.25 - 0.5 kg per tree/ year.
Magnesium	 Early symptoms of Mg deficiency are chlorotic bands on the margin of older leaves, while the central portion remains green.	Leaflet tips are necrotic in very severe cases and older leaves become bronze with a dry appearance. Mg deficiency symptoms are distributed uniformly from base to tip of the leaf.	Apply $MgSO_4$ at a rate of 1-2 kg per tree / year.

Image Credits: E. Ramkhelawan and C. Paul, 2016 Coconut Production Technology; International Trade Centre; Geneva, Switzerland.

References:

1. Ramkhelawan, E. and C. Paul. 2016. Coconut Production Technology. International Trade Centre, Geneva, Switzerland. pp36-42
2. MoA Mindanao development programme, E-learning module for coconut production Online source: http://mrdp.da.gov.ph/eLearning/Coconut

Agriculture Prices at a Glance- $$$$$

MARCH 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	Dist.	Per lb
Fattened steers	L	Czl	1.90	OW	2.05	Bze	1.90
750-1100 lbs	L	Cy	1.30	SCr	N/A	Tol	1.50-1.80
Weaner steers	L	Czl	2.10	OW	2.10-2.25	Bze	2.00-2.05
" "	L	Cy	1.65-1.80	SCr	N/A	Tol	1.80-2.00
Breeding heifers	L	Czl	1.40	OW	1.50	Bze	1.45
" "	H/L	Cy	2.25	SCr	N/A	Tol	1.40
Cull cows	L/H	Czl	1.10	OW	1.30	Bze	1.45
" "	H/L	Cy	1.50	SCr	N/A	Tol	1.00

U.S. CATTLE		
U.S. price - corn fed - 1000-1200 lbs	H	US$ 1.28
U.S. price - feeders 600-800 lbs	L	US$ 1.45550

BELIZE HOGS			
Weaner pigs - 25-30 lbs - by the head	S	100.00	80.00
Butcher pigs 160 - 230 lbs, per lb	S	1.80	1.65

BELIZE SHEEP			
Butcher lambs - live per lb *	S	2.50	2.25
Mature ewes - live per lb	S	2.00	1.75

BELIZE CHICKEN			
Wholesale dressed, per lb (Sp Lkt)	S	2.32	Large Birds 2.20
Wholesale dressed, per lb (Bl Crk)	S	2.36	
Broilers - live per lb (Sp Lkt)	S	1.14	
Broilers - live per lb (Bl Crk)	L	1.18	
Spent hens per 4 lb bird (Sp Lkt)	L	2.90	
Spent hens per 4 lb bird (Bl Crk)	L	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

GRAINS, BEANS & RICE	T	A	B	C
Belize yellow corn, bulk (Spanish Lookout)	H	N/A	N/A	0.21/lb
Belize yellow corn, bulk (Blue Creek)	S	.20 cash/.22 payments	N/A	
Yellow corn/local retail (low volume, Sp Lkt)	H	$24.50/100 lb bag		
Belize white corn, bulk (Spanish Lookout)	-	N/A		
US Corn, #2 yellow	H	US$4.1225 / 56 lb bushel		
US organic, #2 yellow corn feed grade	H	US$8.00-9.75 / bushel		
Belize soy beans (Spanish Lookout)	-/L	0.45 contract	0.42 non-contract	
Belize soy beans (Blue Creek)	S	0.45 cash/0.50 payments		
US soy beans, #2 yellow	H	US$10.7125/60 lb bushel		
US organic, #1 feed grade soy	H	$17.55-18.75		
Belize milo (Spanish Lookout)	S	0.18		
Belize milo (Blue Creek)	S	0.18		
Red kidney beans (Spanish Lookout)	H	$125.00/100 lb bag	N/A	N/A
Red kidney beans (Blue Creek)	S	N/A		
Black eyed peas (Spanish Lookout)	H	$95.00/100 lb bag	no price	
Black eyed peas (Blue Creek)	S	0.82	undetermined	
Paddy rice per pound (Spanish Lookout)	S	0.38-.51 farm price, dried		
Paddy rice per pound (Blue Creek)	S	0.40 farm price, dried		

SUGAR/HONEY		
Sugar cane, ton, estimate	H	$63.51
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	S/L	4.80 (Sp Lkt)	5.25 (Blue Creek)
WD milk per lb to farmer	L	0.54 contract	0.49 non-contract
Raw milk (farmer direct sales)	H	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)	H	US$ 2,209.04

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

HOMEMADE HEALTH
WHY AND HOW TO USE ESSENTIAL OILS – Part 2
By Marguerite Fly Bevis, RN, BSN

This article, part 2 on how to use essential oils, follows part 1 in the Belize Ag Report, August 2017, issue 37, which described the basic properties of essential oils and why they are used. See also issue 30, November 2015 for background information.

There are several ways to use essential oils. *Diffusing* is a way to "clean the air" as the tiny particulars destroy microbes in the air. *Inhaling*, simply smelling the drops on a cotton ball for 90 seconds is an easy and safe method. *Diluting* in a carrier oil such as coconut oil and applying to the skin or affected area is a common method. Some can be applied "neat," that is, applied directly to the skin without a carrier oil. Lavender, tea tree, and rose oils fit into this category. They are gentle on the skin and have therapeutic properties. Use on the neck and chest for respiratory problems; apply directly to irritated joints. The molecules of essential oils are so small they pass easily through the skin and into the bloodstream.

Some essential oils are safe to be ingested internally, for example, citrus oils, lavender, basil, rosemary. Others should be only diffused or applied topically. Consult an essential oils coach for specific ailments.

Risks and Side Effects

Although few side effects occur with the use of essential oils, it is important to realize how very concentrated they are; therefore it takes very little to provide therapeutic effects. Always test a small patch of skin for reactions. Read about each oil and find out if there are interactions with prescription drugs. Grapefruit oil, for example, should not be used if taking prescription medications. Some oils may react with the sun. People taking heart medications such as blood thinners should avoid using clary sage, eucalyptus, ginger, rosemary, sage, thyme and cypress oils. Essential oils are volatile meaning they evaporate quickly. Keep out of direct sunlight in dark amber or blue glass bottles.

When purchasing essential oils, be sure they are 100% therapeutic grade, grown organically. There are several reputable companies online. I am currently experimenting with several and will update in future issues.

Remedies For Specific Condition

Common Cold: The effective oils to use for a common cold are: thyme, which helps drain congestions and helps to rid the body of toxins; lemon, which supports lymphatic drainage; ginger, which relieves discomfort caused by congestion; and eucalyptus and peppermint, which work as expectorants and help cleanse the body of toxins. Home remedy: Make a steam bath by mixing 10 drops each of peppermint and eucalyptus oil in bath water or make a towel tent over your head to inhale the steam for up to ten minutes. Supplement with garlic, Echinacea, and elderberry.

Cough: Peppermint helps open airways and can relieve sore throat pain. Eucalyptus cleanses the body of toxins, dilates blood vessels and allows more oxygen to reach the lungs. Lemon and orange oils encourage lymphatic drainage and boost immunity. Thyme thins mucous and supports the immune system. Home remedy: Add 1 drop each of lemon, peppermint, frankincense, and Roman chamomile to a teaspoon of honey. Consume as needed. Supplement with vitamin C and Echinacea.

Sinusitis: eucalyptus, peppermint, and thyme. Make your own vapor rub: mix 1/2 cup of coconut oil, 1/2 cup olive oil and 1/4 cup grated beeswax into a pan, place over boiling water to melt. Stir and allow to cool. Then add 10 drops each eucalyptus and peppermint. Allow to set. Rub on chest as needed several times during the day.

This is only a brief discussion of the many essential oils available and their uses, not to mention the chemistry. We will continue to examine other oils and discover home remedies for various conditions. Individual essential oils derived from spices that can be grown in Belize include black pepper, ginger, and coriander. There are several more, citrus oils for example, which are steam-distilled from the peel of the fruit. The market for essential oils is growing steadily and is estimated to continue growing into a billion dollar industry. Companies are seeking organic farms to grow the plants they need for distillation into essential oils. Opportunities abound for growers, distillers, and distributers. More importantly, essential oils offer you and your family the opportunity to enjoy the many benefits resulting from simply diffusing them in the home. Mental clarity, focus, calmness and invigoration, just to mention a few. They can literally cleanse the air of microbes while filling your home with delightful scents that brighten the mood. Isn't it time to give them a try?

Write to me with comments or questions at marguerite@pobox.com

Disclaimer: If you are ill, please see a doctor or nurse. This information is not intended to replace medical care.

Source: Dr Josh Axe www.draxe.com

Save our Soils...Continued from pg 15

Reprinted from ACRES USA The Voice of Eco-Agriculture March 2015 • Vol. 45, No. 3

JONES. The aggregate is the fundamental unit of soil function. A great deal of biological activity takes place within aggregates. For the most part, this is fueled by liquid carbon. Most aggregates are connected to plant roots, often to very fine feeder roots, or to mycorrhizal networks unable to be detected with the naked eye. Liquid carbon streams into the aggregates via these roots or fungal linkages, enabling the production of glues and gums that hold the soil particles together. If you gently lift a plant from healthy soil, you'll find aggregates adhering to the roots. The moisture content is higher inside a soil aggregate than on the outside, and the partial pressure of oxygen is lower on the inside than on the outside. These important properties enable nitrogen-fixing bacteria to function. When aggregates aren't forming — because of cultivating the soil or using chemicals or having bare soil for six months or more with no green plants — crops are not able to obtain sufficient nitrogen. The tendency is then to add fertilizer nitrogen, exacerbating the situation. The application of large quantities of inorganic nitrogen interrupts carbon flow to soil, further reducing aggregation.

ACRES U.S.A. It sounds like a vicious cycle.

JONES. Yes, the more N applied, the more soil structure deteriorates and ironically, the less N is available to plants. You'll rarely see a nitrogen-deficient plant in a healthy natural ecosystem. When I was driving home yesterday I noticed yellow, nitrogen-deficient pastures on many of the dairy farms I passed. But in the area between the fence and the road, where no fertilizer had been used, the grasses were a lovely dark green.

ACRES U.S.A. We are familiar with Rhizobium bacteria and their relationship with legumes. What should we know about free-living nitrogen fixing bacteria?

JONES. From an agricultural perspective the most important of the free-living nitrogen-fixing bacteria are associative diazotrophs — so-called because the atmospheric nitrogen that they fix occurs as di-nitrogen (N_2) and associative because, like mycorrhizal fungi, they require the presence of a living plant for their carbon. These bacteria live in close proximity to plant roots or are linked to plant roots via the mycorrhizal highway.

ACRES U.S.A. Isn't our knowledge of these organisms pretty recent?

JONES. The reason we know so little about associative diazotrophs is that most cannot be cultured in the lab. This applies to most species of mycorrhizal fungi as well. As bio-molecular methods for detecting microbes in the soil become more sophisticated, we're realizing there is a lot more life — and a lot more species — than we thought. It has become obvious that there are thousands of different types of bacteria and archaea that can fix nitrogen. The Haber-Bosch process, by which we manufacture nitrogen fertilizer, is a catalytic reaction requiring enormous amounts of energy. Yet microscopic bacteria in the rhizosphere or within plant-associated aggregates can fix nitrogen simply using light energy from the sun, transformed to biochemical energy during photosynthesis and channeled to soil by plant roots.

ACRES U.S.A. I'm a little confused because I understood that there is a difference between mineral nitrogen and organic nitrogen.

JONES. That's correct. Nitrogen-fixing bacteria produce ammonia, a form of inorganic nitrogen, inside soil aggregates and rhizosheaths. Rhizosheaths are protective cylinders that form around plant roots. They're basically a bunch of soil particles held together by plant root exudates. You can easily strip them off with your fingers. Within these biologically active environments the ammonia is rapidly converted into an amino acid or incorporated into a humic polymer. These organic forms of nitrogen cannot be leached or volatilized. Amino acids can be transferred into plant roots by mycorrhizal fungi and joined together by the plant to form a complete protein. On the other hand, inorganic nitrogen applied as fertilizer often ends up in plants as nitrate or nitrite, which can result in incomplete or "funny" protein. This becomes a problem in cattle if it turns up as high levels of blood urea nitrogen (BUN) or milk urea nitrogen (MUN). Nitrates cause a range of metabolic disorders including infertility, mastitis, laminitis and liver dysfunction. There is also a strong link between nitrate and cancer. In some places in the United States it is not safe to drink the water due to excessive nitrate levels. Milk can also have nitrate levels above the safe drinking standard, but people happily consume it, not realizing it's unhealthy.

ACRES U.S.A. These are great points. How dependent is the world on the application of synthetic nitrogen?

JONES. Farmers around the world collectively spend about $100 billion per year on nitrogen fertilizer. I'm greatly inspired by the multi-species cover crop revolution in the United States. Leading-edge farmers like Gabe Brown, Dave Brandt and Gail Fuller are showing it's possible to maintain or even improve crop yields while winding back on fertilizer. These farmers are light years ahead of the science. They're building soil, improving the infiltration of water, increasing water holding capacity and getting fantastic yields. They have fewer insects and less disease. The carbon and water cycles are fairly humming on their farms.

ACRES U.S.A. I want to get your recipe for transforming terra-cotta tile into chocolate cake — that is, turning hard, compacted soil into loose, fragrant soil teeming with life.

JONES. There isn't a "recipe" as such for maintaining soil aggregates (the starting point for chocolate cake). It's really just a set of guiding principles. Soil becomes like a terra-cotta tile when aggregates break down. Hard, compacted soil sheds water. The amount of effective rainfall is dramatically reduced. It's also much harder for plant roots to grow in poorly aggregated soil. The first rule for turning this around is to keep the soil covered, preferably with living plants, all year round. In environments where the soil freezes, it's still important to maintain soil cover with mulch or a frost-killed cover crop or better still, a frost-hardy cover that will begin to grow again as soon as spring arrives. Microbes will go into a dormant phase over winter and re-activate at the same time as the plants. In regions with a hot, dry summer, evaporation is enemy number one. Bare soil will be significantly hotter and lose more moisture than covered soil. Aggregates will break down unless the soil is alive. Aggregation is absolutely vital for moisture infiltration and retention.

ACRES U.S.A. OK, so that's one.

JONES. Point two is to maximize diversity in both cover crops and cash crops. Aim for a good mix of broadleaf plants and grass-type plants and include as many different functional groups as possible. Diversity above ground will correlate with diversity below ground. Third, avoid or minimize the use of synthetic fertilizers, fungicides, insecticides and herbicides. It's a no-brainer that something designed to kill things is going to do just that. There are countless living things in soil that we don't even have names for, let alone an understanding of their role in soil health. It's nonsense to say biocides don't damage soil! In Australia many farmers plant seeds treated with fungicide "just in case." They're actually preventing the plant from forming the beneficial associations

Continued on pg 27

Cattle Auction in Spanish Lookout

Cattle Auctions in Spanish Lookout are becoming an annual tradition for the Joe Freisen family. Joe Jr and Eva Friesen hosted a successful auction on Saturday, 17th February 2018 at their Rocking J. Ranch in the Iguana Creek area of Spanish Lookout.

Twenty-two head were sold: 12 bulls and 10 heifers, 2 donkeys and 1 horse. The average price for bulls was approximately $5,000, with the highest bringing $6,300 and the lowest at $3,500.

Heifers sold averaged $2,700, with the highest at $3,200 and the lowest at $2,300.

Buyers came from Blue Creek, Shipyard, Barton Creek, BirdWalk, San Ignacio and Spanish Lookout. Shipyard and Spanish Lookout were the highest bidders.

**For the 2016 Auction, the average Brahman bull of 15 sold was $3,883, with the 2016 highest selling bull at $5,400. That same sale, JF Brahmans sold 8 bulls averaging $4,038 with their highest at $4,800. The average bred heifer price at the 2016 sale was $2,130 ($2.15/lb).*

Cover photo is Mr. & Mrs. Joe Friesen Sr and their son, auction host Joe Jr. Photos by Mrs. Joe (Eva) Friesen Jr.

Don't forget the BLPA AGM - March 24th

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The Protein Bank
A Project For Cheaper Feed
By Chris Harris


Maralfalfa Protein Bank

Like many small farmers, here at White Rock Farm we have heavy feed bills for our poultry, pigs, sheep and goats. We have been looking for ways to mitigate this burden, and came across the idea of a "protein bank". We're also looking for feed which will be more nutritious, more natural, and more sustainable. We're very conscious that we depend heavily on corn and corn derivatives, and corn prices can fluctuate quite a bit.

Of course feeding farm animals on cut and carried hay, grasses, and various foliage such as madre de cacao, banana leaves, cassava and more is not a new idea. But perhaps something more systematic is worth another look, especially for those on a tight budget.

We had originally planned simply to improve a few rather badly drained and sour areas of pasture, which sported a lovely crop of weeds which nothing seemed to want to eat, so that we could grow grass there instead. We moved our family of pigs in, and had them "pig tractor" it up, to their great delight. The soil was fertilized, tilled, and to a large extent, rid of weeds. This was followed with a crop of fertilizer beans, which we allowed to wilt into the soil. We were somewhat disappointed to see that weeds were emerging again, and while we were considering our next move, we discovered the concept of protein banks. (Actually, we had vaguely known about it for a while, but never really looked at it closely. But as a farm develops, sometimes it takes you to unexpected places.)

Instead of sowing normal grazing grass, which might last the sheep a week or two before they had to be moved on, why not grow shrubs and small trees which can be coppiced, the leaves and small branches chopped up, and the feed carried to all the animals on the farm? So we began to see what might be do-able here in Belize.

The first step was to recognize that to be worthwhile, the quantities of feed needed to be pretty big, relatively speaking. Hand gathering of raw material was relatively easy using a sharp machete, but converting sheaves of grass, leaves, young shoots and so on into edible feed needed simple mechanization. The plants were coppiced – cut down to around three feet high, in rotation, and allowed to shoot up again. Coppicing is something with which we were familiar from the UK, where it's widely used as a hedgerow technique and for managing willow trees.

With this in mind, and with the advice of Central Farm, we bought a gas driven 6Hp chipper from Shipyard, and added a large hopper to contain the shredded material after processing. We should be able to grind some of the raw material down to a fine enough feed to be suitable for poultry, with perhaps some sieving, as well as keeping the more coarsely chopped material for sheep, calves and goats.

The next step was to gather suitable raw material. To this end we have planted nacadera, white mulberry, maralfalfa (a high protein Colombian variety of elephant grass), moringa and sugar cane, plus one or two root crops such as white yam, sweet potato, cassava etc. We now face a wait of several months until the various crops reach maturity. In the meantime we will be experimenting with what crops we already have such as madre de cacao and cassava etc. (Madre de cacao is a good natural wormer, but should only be fed in small quantities.)

We'll probably end up with around two acres of protein bank, but we are busily looking for nooks and crannies around the farm where we can plant white mulberry in particular. This is a large shrub/small tree, which grows to about twelve feet, and we have a few spots where we will be planting it to use as a shelter belt against the dry season dust from the road. As it's a reasonably attractive plant, and even has berries which can be used for jam making, it can be fitted in quite nicely into odd corners just to add a little extra to the party.

The formalizing of what has been done for many centuries by farmers around the world, into a *protein bank* leads us to a closer look at the feed itself. The component plants, grasses and trees all share the characteristic of being high in protein as well as other nutrients, and it is this that makes them valuable. Of course this idea does not replace the need for some additives such as ground corn, and other grains, nor indeed supplements for egg laying chickens. But we anticipate an overall saving in our weekly feed bills, the objective being to cut them in half.

So where did this formalization come from? Well, it came from our friends at Central Farm who introduced us to the idea originally, and who incidentally supplied us with the shoots and cuttings we needed to start the process going, as well as informative leaflets. It turns out that the concept of protein banks is one used widely in Africa where feed issues are an even higher priority than they are here in Belize

Later in the year we will report back on the progress of the project. Re-inventing the wheel? Maybe - we shall see.

Chris Harris, White Rock Farm, Springfield, Belmopan.

Ramon - also known as Maya Nut

By Ina Iris Sanchez

Brosimum alicastrum, a member of the fig/mulberry family, can be considered one of the 'miracle trees' found in our forests. It has over 50 common names but we may know it as Maya nut, ramon, or Iximche (corn tree). The name Iximche derives from the classical Maya words *ixim,* meaning corn or grain, and *che,* the word for tree. The Spanish name ramón derives from the word 'ramonear', meaning '*to forage'* and makes reference to one of the widespread uses of the tree as feed for livestock. Maya nut refers to the seed of the tree and is known as being a nutrient-dense food that was a staple in the diet of the Maya civilization. The importance of the Maya nut has long been known to archeologists and anthropologists and early studies have alluded that not only was the tree widely used by the Maya but that it may have deliberately been cultivated. The Maya nut forest once ranged from central Mexico to northern Brazil and the Caribbean. However, due to the widespread land clearing for the expansion of agriculture, the Maya Nut Institute estimates that only 5% of the original Maya nut forest cover remains.

Description

The Maya nut tree is an evergreen or sub-perennial tree that can grow up to a height of 45 m but with an average height ranging between 20-30 m. It is found in lowland areas of hot, humid, tropical climates with seasonal dry periods and grows best in areas where annual day temperatures are within the range 18 - 25°C. The adequate annual rainfall ranges between 600-4,000 mm but well established trees are drought and flood tolerant. While humus-rich, fertile soil is the optimum, studies have shown that the Maya nut tree does very well in shallow, calcareous soils.

The tree starts producing fruit in 5-6 years when planted from seed; flowering and fruit production differ depending on the location. It is very important to note that Maya nut trees can be either monoecious (having male and female flowers on the same tree), dioecious (having separate male and female trees), or hermaphroditic (changing sex from female to male as they age). The reproductive ecology of the Maya nut in your area will be key in understanding whether you will be using the tree for fodder or for the collection of nuts.

Table 1. Fruit production of *Brosimum alicastrum* in 6 countries.

Source: E. Vohman (2014). Maya Nut Institute

Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
El Salvador												
Guatemala												
Honduras												
México												
Nicaragua												
Perú												

Multi-functionality of Maya Nut

For livestock

With crude protein ranging between 8% - 30%, the leaves and young branches are an excellent source of forage for livestock. They constitute an excellent fodder for cattle, goats, sheep, horses and pigs. The nutritional characteristics of the ramon tree are superior to *Leucaena leucocephala* and is well accepted by different breeds of cattle. The leaves and fruits are more nutritious than alfalfa. This tree is very appreciated due to the quality of its forage and its availability during the drought. These trees are harvested between four to six years of age and are pruned once or five times a year. In some areas in Guatemala, for example, the branches are cut for fodder in the dry season and in where trees grow in pastures (at the same time to provide shade) the animals eat the fruits that fall to the ground. Seeds can be used in feed preparations to partially substitute commercial grains due to their high protein content, carbohydrates, vitamins A, B2 and niacin.

Medicinal

Its main medicinal application is in the treatment of respiratory tract conditions, with asthma being the condition for which it is used most frequently. For the treatment of stomach acidity one cup of the tree resin diluted in water is administered in the morning and another before going to bed.

Human Consumption

In addition to all the mentioned properties, the human consumption of seeds stands out. They are round and of the size of a hazelnut. They can be cooked, roasted or grilled. If they are boiled, they acquire a consistency and flavor similar to potatoes and can be eaten this way or you can use them to thicken broths. Some indigenous communities in Chiapas, Quintana Roo and Yucatan have used the seed to prepare tortillas when they have been faced with a poor corn harvest. With further processing of the nut a substitute for coffee (without caffeine) is produced, as well as flour for bread or biscuits. Maya nut is high in fiber, calcium, potassium, folate, iron, zinc, protein and vitamins A, B, C and E, and contain tryptophan which is a relaxing agent that helps fight insomnia, and unlike almonds, walnuts and pecans they don't contain tree allergens.

Maya Nut/Ramon tree. Source: CONAFOR (2009)

Maya Nut seed. Source: CONAFOR (2009)

Maya Nut Pudding (Source: Maya Nut Institute)

4 ½ cups milk

Sugar to taste

*¾ cup toasted and ground M*aya nut seeds

4 tbsp corn starch

1 tbsp vanilla

Mix 4 cups of milk, sugar to taste and the toasted and ground Maya nut and boil. Mix cornstarch with 1/2 cup of cold milk and add to the pot. Leave on heat 7-10 minutes until thick; move constantly to avoid burning. After thickening, remove the pudding from the heat and add vanilla.

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that it needs in order to protect itself. After a few weeks of crop growth, they will then apply a "preventative" fungicide, which also finds its way to the soil, inhibiting the soil fungi that are essential to crop nutrition and soil building. The irony is that plants are then unable to obtain the trace elements they need to fight fungal diseases. We see many examples of crops grown biologically that are rust-free, side-by-side with rust infected plants in neighboring fields where fungicides are being used. There is an analogous situation with human health. Not that long ago the cancer rate was around one in 100. Now we're pretty close to one in two people being diagnosed with cancer. At the current rate of increase, it won't be long before nearly every person will contract cancer during their lifetimes. Cancer is also the number one killer in dogs. Isn't that telling us something about toxins in the food chain? We're not only killing everything in the soil, we're also killing ourselves — and our companion animals. Is that what we want for our future?

ACRES U.S.A. Are you a cancer survivor?

JONES. Yes, I am, which is basically why I do what I do. But I don't say a lot about that because if you start your talk with "we're all going to die from cancer unless we change," people tune out. It's too threatening. Most of us have lost loved ones through cancer.

ACRES U.S.A. You say it's not just the toxins in our food that are the problem, but the use of biocides — chemicals that kill living organisms — which reduce the nutrient content of food. And you attribute that nutrient reduction to the inhibition of the plant-microbial bridge.

JONES. Spot on. If the plant-microbe bridge has been blown, it's not possible for us to obtain the trace elements our bodies need in order to prevent cancer — and a range of other metabolic disorders. Cancer is not a transmissible disease. It's simply the inability of our bodies to prevent abnormal cells from replicating. To date, the response to the cancer crisis has revolved around constructing more oncology units, employing more oncologists and undertaking more research. The big breakthrough in cancer prevention will be in changing the way we produce our food.

ACRES U.S.A. We have plenty of evidence from meta-studies that the nutrient content of produce grown organically tends to be higher than produce grown chemically. We also have documentation of steep declines in nutrient content in a number of foods over the last century.

JONES. Yes, we're getting a double whammy. We're ingesting chemical residues, but not the trace elements and phytonutrients we need for an effective immune response. Plants need trace elements, like copper and zinc, to make these phytonutrients. But the trace elements will not be available in the absence of an intact microbial bridge.

ACRES U.S.A. You've talked about the pressure on farmers to have tidy farms and uniformity in their fields. It seems like one of the problems you're identifying is a faulty understanding of what it means to farm well and to be a good farmer. What are some of the qualities that farmers think they should have that get in the way of building healthy soil?

JONES. I must admit that in the early '90s, when I first started going onto farms that were using holistic planned grazing, I was a bit shocked to see the number of weeds popping up. These weeds would have been sprayed under the former management regime, but the ranchers were saying, "Don't worry. We have to pass through this weedy stage. If we spray weeds, we create bare ground and the weed seed that's there means the weeds simply come back." There's a saying, "the more you spray weeds, the more weeds there will be to spray." It's oh so true! Continually reverting to bare ground creates more problems than it solves. Those ranchers knew some weeds had deep roots that bring up nutrients. Leaving them there meant better quality plants would eventually be able to grow in the improved soil and replace the weeds. That is exactly what happened. Over the last 60 years we've tried — and failed — to control weeds with chemicals. One of the exciting things

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about the multi-species cover crop revolution that's underway in the United States is that the greater the variety of plant types you use, the more niches you fill and the less opportunities there are for weeds. Cover-crop enthusiasts are experimenting with 60 or 70 different species in their mixes. I see the trend to polyculture as the most significant breakthrough in the history of modern agriculture. Even so, the first time you see a multi-species cover or a cash crop grown with companion plants, you might think, "Wow, that looks untidy" because we're not used to it. It takes a little while to realize that having all those different plants together is really beneficial. Somehow we have to change the image of what a healthy field looks like so that when people see bare ground or a monoculture, they recognize it's lacking — and that this is not a good thing.

ACRES U.S.A. What sort of response are the cover crop pioneers receiving?

JONES. They're seeing fantastic results. The trouble is they are not getting the accolades they deserve. This is slowly beginning to change. NRCS, in particular, are being exceptionally supportive of these leading-edge farmers. Cover cropping is now generating a huge amount of interest. Recently I visited Brendon Rockey, a young potato farmer in the San Luis Valley of Colorado. Brendon has increased irrigation efficiency 20 percent through the use of cover crops. There is increasing worldwide recognition of the fact that multi-species cover crops improve soil-water relationships.

ACRES U.S.A. Right, another aspect of that abundance.

JONES. If there is a bare fallow between crops — or bare ground between horticultural plantings such as grapes — soil aggregates break down. As a result, water cannot infiltrate as quickly. It remains closer to the surface and evaporates more readily. Lack of aggregation also renders the soil more prone to wind and water erosion. We have this fear that if we grow companion plants or a cover crop, they're going to use up all the water and nutrients. We have to realize that by supporting soil microbes, a diversity of plants actually improves nutrient acquisition and water retention.

ACRES U.S.A. In the transition period from a chemically intensive system where you don't have a functioning plant-microbial bridge, what are some kinds of practices that farmers can use?

JONES. Sometimes when farmers realize the importance of soil biology they immediately stop using fertilizers and chemicals. This is not necessarily a good thing. It takes time for soil microbial populations to re-establish. If the soil is dysfunctional, chances are the wheels will fall off when fertilizers are pulled. If there is a failure, farmers will revert back to what they know ... chemical agriculture. You have to wind back slowly and accept that it's going to take time to transition. The key to getting started is to experiment on small areas. It's a matter of dipping a toe in the water. Include some clovers or peas with your wheat, or vetch with your corn — just on one part of the field. This reduces the risk. When farmers see that they've gained rather than lost yield — and that the crop looks healthier — they will be inspired to try a larger area and a greater variety of companion plants next time. Another option is to plant a multi-species cover crop on part of the land that would normally be devoted to a cash crop. You're exceptionally lucky in the United States in that a lot of farmers are experimenting with cover crops now. Once the diversity ramps up, the ladybirds and lacewings and predatory wasps appear and the need for insecticides falls away. And after heavy rain, it's obvious that water has infiltrated better in the parts of the field where the cover crops were. Gradually the changes become an integral part of farming — an exciting part, in fact. Experimentation and adaptation become the norm, rather than conformity. Confidence builds, as ways to restore healthy topsoil become firsthand knowledge.

ACRES U.S.A. What about fertility?

JONES. It's important to cut back on chemical fertilizers slowly. If you've been using loads of synthetic nitrogen, then free-living nitrogen-fixing bacteria won't be abundant in your soil. An easy way to transition is to reduce the amount of nitrogen applied by around 20 percent the first year, another 30 percent the next and then another 30 percent the year after. At the same time as reducing fertilizer inputs it's absolutely vital to support soil biology with the presence of a wide diversity of plants for as much of the year as possible. Another way to gradually reduce fertilizer inputs is to use foliar fertilizers rather than drilling fertilizer under the seed. Foliar-applied trace minerals can also help during transition. These can be tank-mixed with biology-friendly products such as vermi-liquid, compost extract, fish hydrolysate, milk or seaweed extract. Whichever path you choose to support soil biology, the overall aim is for soil function to improve every year. The overuse of synthetic fertilizers will have the opposite effect.

ACRES U.S.A. You mentioned the longest-running field experiment in North America that found that high nitrogen depletes soil carbon?

JONES. The Morrow Plots are the oldest continuously cropped experimental fields in the United States. A team of University of Illinois researchers investigated how the fertilization regimes that were commenced in these plots in 1955 affected crop yields and soil carbon and organic nitrogen levels. They discovered that the fields that had received the highest applications of nitrogen fertilizer had ended up with less soil carbon — and ironically less nitrogen — than the other fields. The researchers concluded that adding nitrogen fertilizer stimulated the kind of bacteria that break down the carbon in the soil. The reason there is less nitrogen in the soil even though more has been applied is that carbon and nitrogen are linked together in organic matter. If carbon is decomposing, then the soil will also be losing nitrogen. They decompose together.

ACRES U.S.A. That's fascinating. Tell me about David Johnson and what he is finding in his research at New Mexico State University.

JONES. Dr. David Johnson is based in Las Cruces, south of Albuquerque. He has discovered that the ratio of fungi to bacteria in the soil is a more important factor for plant production than the amount of available nitrogen or phosphorus. Sadly, in most of our agricultural soils, we have far more bacteria than fungi. The good news is that farmers use multi-species cover crops, companion crops, pasture cropping and other polycultures — and the ranchers who manage their perennial grasses with high density short duration grazing accompanied by appropriate rest periods — are moving their soils toward fungal dominance. When you scoop up the soil, it has that lovely composty, mushroomy sort of smell that indicates good fungal levels. Oftentimes agricultural soils have no smell or a smell that is a bit sour. Fungi are important for soil carbon sequestration as well as nutrient acquisition. The formation of humus, a complex polymer, requires several catalysts, including fungal metabolites.

ACRES U.S.A. That is a really interesting insight. I would like to get some perspective on soil degradation. You've written about how lush

and green Australia's landscape was at the time of European settlement in the early 1800s, land that's now desertified. How do your readers react?

JONES. They have a particularly hard time believing that the southern and southwestern parts of Australia supported green plants during our hot, dry summers. It's fortunate that some of the first European settlers kept journals. George Augustus Robinson, who was the Chief Protector of Aborigines, kept a daily journal for several years. Robinson was a keen observer. He made sketches of the landscape as well as describing it. In summertime when it was over 100 degrees and without rain for months on end, Robinson noted green grass and carpets of wildflowers everywhere he looked. Sadly, we don't know what many of these plants were because we no longer have wildflowers in some of the colors he recorded.

ACRES U.S.A. Could you reconstruct what happened to destroy all this lush, diverse vegetation?

JONES. European colonists brought boatloads of sheep which rapidly multiplied. In England you could have sheep in continual contact with the grass and it didn't matter greatly because it nearly always rained. Australian weather tends to oscillate between drought and flooding rain and the English weren't used to that. By the late 1800s there were many millions of sheep in Australia, grazing the grasslands down to bare earth in the dry periods. When it rained, the unprotected soil washed away. The river systems and wetlands filled with sediment. We're now farming on subsoil. We've lost around 2 to 3 feet of topsoil across the whole country. The original soil was so well aggregated that aboriginal people could dig in it with their bare hands. The first Europeans to arrive in Australia talked about two feet of black "vegetable mold" that covered the soil surface. Today our soils are mostly light-colored. The use of color to describe soils only came into being after the carbon-rich topsoil had blown or washed away. It's not an uncommon story. Just about every so-called civilized, developed country in the world has lost topsoil by one means or another. In the States you had your Dust Bowl, created by tillage. Restoring the health of agricultural soils will require more than learning how to minimize soil losses. We need to learn how to build new topsoil, and we need to learn how to do it quickly.

ACRES U.S.A. I read that in Australia, using the so-called best management practices of stubble retention and minimal tillage, wheat production results in the loss of 7 kilograms of soil for every kilogram of wheat harvested. Is it still that bad?

JONES. Yes, probably worse. I have documented evidence of 20 tons of soil per hectare per year being lost through wind erosion. The average wheat yield in Australia is very low, around 1 ton per hectare. We lose massive amounts of soil to achieve it. The current situation is not sustainable.

ACRES U.S.A. How much of Australia's farmland would have to increase soil carbon to offset your country's carbon emissions?

JONES. It would require only half a percent increase in soil carbon on 2 percent of our agricultural land to sequester all Australia's CO_2 emissions. Our emissions are low in relation to our land area because we have a relatively small population.

ACRES U.S.A. Do you have any idea worldwide how much farmland would have to be managed differently to increase soil carbon sufficiently to reverse global climate change or offset greenhouse gases?

JONES. Agriculture is the major land use across the globe. According to the FAO there are around 1.5 billion hectares of cropland and another 3.5 billion hectares of grazing land. Currently much of that land is losing carbon. No doubt there will be — and indeed there already have been — endless arguments about how much carbon can be sequestered in soil. In my view it's not a matter of how much but how many. The focus needs to be on transforming every farm that's currently a net carbon source into a net carbon sink. If all farmland sequestered more carbon than it was losing, atmospheric CO_2 levels would fall at the same time as farm productivity and watershed function improved. This would solve the vast majority of our food production, environmental and human health problems. I'm disappointed to see that articles are still being published in internationally recognized peer-reviewed soil science journals — as recently as 2014 — downplaying the potential for carbon sequestration in agricultural soils. Predictably, these articles fail to mention plant roots, liquid carbon or mycorrhizal fungi. Many scientists have confused themselves — and the general public — by assuming soil carbon sequestration occurs as a result of the decomposition of organic matter such as crop residues. In so doing, they have overlooked the major pathway for the restoration of topsoil. Activating the liquid carbon pathway requires that photosynthetic capacity be optimized. There are many and varied ways to achieve this. I have enormous respect for the farmers and ranchers who have done what the experts say can't be done. If we have a future, it will be largely due to the courage and determination of these individuals.

ACRES U.S.A. You initiated the Australian Soil Carbon Accreditation Scheme (ASCAS). I'm quite impressed that one person started something like that.

JONES. I launched ASCAS in 2007 out of frustration that the federal government wasn't doing anything to reward innovation in land management. I wanted to demonstrate that leading-edge farmers could build carbon in their soils and be financially rewarded for doing so. But my attempts were blocked at every level, including being subjected to public ridicule. I suspect much of the resistance stemmed from the fact that Australia was importing over $40 billion worth of farm chemicals and policy-makers saw that as a big business. They realized that in order to build soil carbon, farmers would need to reduce chemical use. There were other issues too. Australia ratified the Kyoto Protocol nine months after the launch of ASCAS. Under Kyoto Protocols, the issuance of carbon credits requires adherence to the 100 year rule, which basically means that any payment for soil carbon must be registered on the land title and the money refunded if for any reason the carbon levels fall over the ensuing 100 years. Then there's the additionality rule, which states farmers cannot be paid for changes in land management that they would have made anyway, or that result in higher profits.

ACRES U.S.A. You said this story has a good ending.

JONES. Despite the roadblocks, I felt it was important that soil restoration pioneers be recognized. Late last year we decided to discard the original ASCAS model and start afresh. On March 19, 2015, almost eight years to the day after we launched the ASCAS in 2007, our patron Rhonda Willson will present 11 Soil Restoration Leadership Awards at a farming forum in Dongara, Western Australia. It's a fitting conclusion that these awards be presented in the International Year of Soils.

ACRES U.S.A. What changes did your Soil Restoration Leaders make in order to improve soil function?

JONES. The agricultural region of Western Australia experiences an extremely hot, dry summer. Winters are cool and moist, although not as moist as many farmers would like. Innovative ranchers have been planting summer active grasses at the end of winter when there is sufficient moisture for germination, despite 'expert' opinion that it's too hot and dry in summer for anything to grow. Perennial grasses have incredibly deep root systems and form mycorrhizal associations that help them survive. The grasses soon create their own microclimate. It's an absolute delight to see these patches of green in an otherwise parched landscape. It helps us understand how the countryside encountered by the first European settlers was able to remain green over the summer.

ACRES U.S.A. At the People's Climate March in New York City, a large contingent of vegan activists carried signs blaming cattle as a major cause of global warming. What are your thoughts on targeting ruminants for greenhouse gas emissions?

JONES. There were more ruminants on the planet 200 years ago than there are now, but we've gone from free-ranging herds to animals in confinement. That changes everything. Firstly, we're growing feed for these animals using fossil-fuel intensive methods and secondly, confinement feeding creates a disconnect between ruminants and methanotrophs. Methanotrophic bacteria use methane as their

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Grand Opening of Seven Miles Women's Group (SMWG) Gift and Snack Shop And Seven Miles Farmers Association (SMFA) Greenhouses

November 2017 was an exciting month for the El Progresso (Seven Miles) community located near the Chiquibul National Park; two groups there are grant recipients, beneficiaries of the project entitled, "Promoting Sustainable Natural Resource-based Livelihoods in Belize (PSNRL)" being implemented by the Government of Belize, funded by the Japan Social Development Fund, and administered by the World Bank. The objective of the PSNRL is aimed at "promoting viable and sustainable natural resource-based livelihoods for poor communities in Belize and, thereby, reducing anthropogenic pressures on key natural resources".

The SMWG and the SMFA are the beneficiary groups in the community of the PSNRL project**.** The four-year long journey culminating in the grand opening of the gift and snack shop included numerous training workshops, planning sessions, paperwork and coordination. The group thanked God for sustained health and energy, many community people who helped in various ways, and the people from Belize Enterprise for Sustained Technology (BEST), particularly Managing Director Dennis Jones, Project Coordinator Michelle Longsworth, Technical Office Joe Lisbey, Procurement Officer Javier Garcia and Community Coordinator Amparito Itza.

The solar-powered facility with backup generator has been equipped not only for food preparation and selling but also for teaching sewing, agro-processing, and selling locally-made gifts. The women are well on their way to full function; having received training in plant grafting and propagation, they have started a plant nursery as well. The diverse array of food in the lunch buffet that was served after the grand opening ceremony testified to their highly developed skills at cooking and baking.

The SMWG Gift and Snack Shop is open 8:00 – 4:00 Monday through Saturday. Stop in and enjoy some of their home-type cooking. It is planned that the food served in the facility will be made from local produce and that eventually the produce will be sold on that site as well.

The Seven Miles Farmers Association is comprised of 16 farmers who used their grant money to construct 8 greenhouses, buy some seeds, seedling trays, one roto-tiller, one bedder and some spray pumps. Each greenhouse measures 100 feet by 18 feet and cost $13,000 per structure; the farmers' goal is to grow pesticide-free produce. Two farmers share each greenhouse; they staggered the planting of their pepper plants to allow for a continuous harvest over an extended period. They are also experimenting with the number of plants to maximize size of pepper and harvest. Starting with fallow ground leased from a local owner, the farmers obtained seed from Guatemala, whose climate is the same as Belize, and used yellow sticky traps for residual pests in the new structures. The first to plant, Byron Arevalo started harvesting 9 weeks after planting; he is harvesting both yellow and green peppers from his 700 plants; he wants to plant purple peppers in his next planting. The farmers plan to grow tomatoes as well; they are presently looking for suitable seed.

Nestled in a valley at an elevation of about 800 feet, Seven Miles receives its water by gravity feed from a reservoir in the hills at some 1285 feet that is fed from higher elevation streams at about 1650 feet elevation. The farmers are currently selling their peppers in San Ignacio market and their plan is to label their produce as pesticide-free.

Sapodilla Trees in Belize

By Mary Susan Loan

Growing and harvesting sapodilla trees have been an important contribution for nutrition, healing, chicle production, building and boosting the economy of Belize for many centuries. Many birds and animals depend on the sapodilla tree for food and shelter.

Sapodilla *(Manilkara zapota)* is a member of the Sapotacceae family. It is also known as naseberry, chicle tree, dilly, chiku or chico. The tree is a hardy, slow-growing, long-living evergreen which can grow in the wild up to one hundred feet in height. When grown under cultivation the trees generally reach about thirty-to-fifty feet. The foliage of the tree is medium green with glossy, leathery alternate leaves. The bark is coarse and dark brown with cracks running vertically. There are over one hundred known cultivars growing in tropical countries world-wide. Sapodilla trees are believed to have originated in the Yucatan peninsula, Caribbean, southern Mexico, Guatemala and Belize. India is presently the world's largest producer.

The tree is known for its round-to-oval shaped fruit usually about two-to-five inches long. The brownish skin is similar to a kiwi without fuzz. Sapodilla fruit may be harvested up to twice a year in Belize. However the trees on our farm produce a bumper crop only once a year, with harvest starting in December and lasting until early March. When ripe, the fruit is delicious and is said to taste like a combination of banana, mango, and jack fruit with the consistency of a ripe pear with malty brown sugar undertones and a hint of jasmine aroma. The flesh may be anywhere from creamy beige, yellow, apricot, tan or slightly brownish-orange in color. When not ripe the fruit oozes a white gooey latex substance which makes your lips stick together and the taste is remarkably acidic and astringent. You will be able to tell when the fruit is ripe by pressing the fruit. If the fruit is soft, not hard, not mushy and smells sweet and the brownish skin smooth or slightly wrinkled, it is ready to enjoy. The center of the fruit can contain three to ten blackish oval seeds with a tiny hook. The fruit may be eaten out of your hand, or peeled and cut into slices, mostly raw; sapodilla fruits are seldom cooked. They have been solar-dried by the Maya for centuries to help ensure a fruit food source year-round. A simple smoothie recipe is as follows: 2 cups milk (dairy or non-dairy), 2 cups peeled and chopped ripe sapodilla fruit, 1 ripe banana, 1 cup ice cubes, a dash of vanilla. Combine all ingredients together then mix in a blender until smooth. Sapodilla fruits provide an excellent source of nutrients, including vitamins A and C, folate, niacin, and pantothenic acid as well as the minerals potassium, copper and iron. They are also rich in antioxidants, anti-inflammatory and antiviral elements. The fruit is high in fiber and used to treat diarrhea and dysentery. The seeds, boiled as a tea, are used as an anti-parasitic.

Sapodilla trees are easy to grow and care for in the tropics. Trees are usually started from seed; some commercial growers use grafting, and air-layering. Trees, pollinated by bats, flourish in limestone and thrive without fertilizer. A combination of nitrogen, phosphoric acid and potash may be used to help boost tree growth. It takes approximately five to eight years for the trees to bear fruit. Sapodilla trees grow well in tropical dry and wet forests and favor some shade. They are pest- and wind-resistant and can survive hurricanes.

Itz, meaning a sacred creation of life, is the name the Maya gave to the milky latex that exudes from the tree when the bark is slashed. *Itz,* now known as chicle, has been used since ancient times as a source of chewing gum. Starting at the end of the 19th century, chicle was harvested as a source of a sugared version of the tasteless processed gum. Men known as 'chicleros' lived in the jungle for months at a time in the wet season of Guatemala, the Yucatan and Belize. Chicleros worked from sun up until sundown, collecting sap in the morning and boiling it down in the afternoon. Harvesting the gummy latex in the jungle was hard work: slashing the tree, collecting the sap, boiling it down in thirty gallon iron pots, then making the chicle into blocks to be carried by mule to be floated down the river, then shipped to the factories in the north to make chewing gum. In the 1930's a synthetic version of chicle started the decline of the chicle market. Regulations to tap trees only thirty years or older and every seven years was not followed and the supply of chicle dwindled. In Japan the use of natural chicle is making a comeback. A forest community numbering over one thousand persons in Peten, Guatemala continues to harvest chicle.

Wood from the sapodilla tree is very dense, strong and disease resistant. The wood is so heavy it does not float. Carved lintels and wooden beams of many Maya temples were made from sapodilla wood. Some lintels have survived intact for over 1,200 years! The beautiful pinkish colored wood is also used to make durable furniture, flooring, ax and hammer handles, fence posts and railroad ties.

Once considered to be an exotic tropical invasive tree, over-harvesting of the wood has brought the once estimated one million trees in parts of Belize, Guatemala and the Yucatan to now numbering in the thousands. Although no longer harvested for chicle in Belize, the sapodilla tree fruit is seasonally available in the market place.

Industrial Hemp Cultivation in the Tropics

By Karin Westdyk


Industrial Hemp

It is important to understand the differences between industrial hemp and marijuana. Technically, industrial hemp and marijuana are from the same plant genus: cannabis. However, the genetics of industrial hemp and marijuana have evolved from different subspecies and there are many important chemical and physical differences.

Chemically, marijuana typically contains between five and twenty percent tetrahydrocannabinol (THC), while industrial hemp contains only about one-tenth of that. Most THC is formed in the resin glands called trichomes on the flowers of the female plant. These glandular trichomes produce and store large amounts of cannabis resin and the female plants are particularly rich in glandular trichomes. Unlike marijuana, industrial hemp is not cultivated to encourage high levels of THC, and therefore lacks the primary component that would make it psychoactive.


Marijuana


Marijuana

Therefore, when growing, the plants have a distinctly different appearance; this single difference in the chemical make-up is what most people rely on to distinguish industrial hemp from marijuana. For example, in Canada, where hemp comprises a growing part of the agricultural economy (over 90,000 acres planted with retail sales close to $40 million), there is a maximum THC content of industrial hemp at 0.3%. Cannabis with higher levels of THC is considered marijuana instead. Canada also maintains an online list of the names of seeds that produce plants acceptably low in THC, many of which are no longer even checked for THC levels as they have proven to be consistently low.

There are other distinguishing factors as well. Industrial hemp has a much stronger fiber; the cellulose and hurds can be used in making rope, paper, building materials, fuel, and plastic. Marijuana fiber is weaker and breaks easily, making it a poor fibrous plant when compared to industrial hemp.

One of the main differences is in how the two are cultivated. Industrial hemp is tall and spindly growing tightly compacted with 30 to 40 plants per square foot and reaching 6-15 feet in height, while THC-producing marijuana plants are grown to an average of only 4-5 feet and are far more spread out. The cultivation of psychoactive marijuana also requires a great deal more attention since the objective is to encourage the plant's flowers to produce more psychoactive THC containing resin. Once the male plants declare, they are generally removed in order for the female plants to pump out more THC resin awaiting pollination. These also produce few if any seeds as a result of male plant pollinator removal. On the other hand, since the hardy parts of industrial hemp are the most desired, along with the seeds, both male and female plants are used producing a higher crop yield with many seeds that can be made into biofuel and/or a highly nutritious food. Industrial hemp plants have very little potential to produce high-content THC and when pollinated by members of their own subspecies, their genetics remain similar, i.e., with continued low levels of THC.


Industrial Hemp

Industrial hemp can be grown in a wider range of soils than can marijuana; it grows on marginal land not suited for growing food crops. Depending on where and how it is grown, industrial hemp requires little-to-no fertilizers or pesticides and the most effective pesticides can be derived from organic sources such as neem oil. Ideally, and initially, industrial hemp could be grown on fields that provide high yields for corn, which is why it makes a perfect rotation crop -- choking out weeds, eliminating the need for toxic, expensive herbicides and pesticides, cleaning the soil from previous use of agrochemical poisons, while providing an excellent amendment to the soil -- replacing organic matter and, with its extensive root system, aerating the soil that will nurture the corn.

Depending mostly on the climate, sown seeds produce plants that can be harvested within 70 to 140 days. According to the Agricultural Marketing and Resource Center, a U.S. information resource for value-added agriculture, "One acre of hemp can yield an average of 700 pounds of grain, which in turn can be pressed into about 22 gallons of oil and 530 pounds of meal. The same acre will also produce an average of 5,300 pounds of straw, which can be transformed into approximately 1,300 pounds of fiber." The fiber can be used for rope, fabric, paper, cellulosic fuel, and/or building materials.

Those concerned about growing marijuana within industrial hemp crops can be assured that since industrial hemp is grown tightly together and is very tall and thin, any THC-producing marijuana would stand out like a sore thumb and would not thrive. Its wide growth would require a large amount of space in order to get adequate sunlight from beyond the tops of the taller competing industrial hemp plants.

Considering the fact that hemp is one of the most versatile and adaptable plants on earth and grows and thrives just about anywhere, growing hemp in the tropics could present a unique set of opportunities as well as challenges. Special cultivars for producing either seed or fiber or a combination of both are needed as well as seeds that will grow well in a tropical climate. Temperate cannabis seeds grow plants that depend on certain light conditions. The shorter days in the tropics will cause them to quickly mature and flower, going into reproductive mode too early. Another challenge is moisture during the rainy season; mold-resistant plants would be best in the tropics. The success of industrial hemp in the tropics depends largely on the origin of the seed. Latitude, day length and humidity are all factors to consider when choosing the best seeds.

A successful tropical industrial hemp project conducted at the University of Hawaii initially used 3 different cultivars and found that the temperate zone seeds did not do well, but the tropical seed hemp and tropical fiber hemp flourished. It demonstrated that the best tropical strains were sativa plants (as opposed to indica or ruderalis varieties) evolving from Thailand, Cambodia, Mexico, Jamaica or Colombia, as sativas grow taller with lots of space between the leaves allowing for better air ventilation to help avoid mold.

An initiative to foster research and education has been established in Belize to support agricultural practices and choices that do no harm. Industrial Hemp Education and Research Association of Belize has a website to gather and research information on growing industrial hemp in Belize. It is believed that industrial hemp could transform the economy of Belize in positive and beneficial ways, and therefore should be explored to its full potential. The website is www.hempbelize.org.

Since industrial hemp is so different from high-THC marijuana, it makes perfect sense that its cultivation be fostered in Belize. Nutritionally, hemp seeds provide the highest form of amino acids in the plant world, and is second only to soy in protein. Organizations and churches interested in alleviating world hunger or in preparing for a future food shortage are working to develop a highly nutritious and abundant food combining moringa with hemp seed. The education of children has proven to be greatly improved when children's bodies and minds are nourished with good nutrition. Those interested in clean renewable energy and the environment place hemp at the top of the chart in biofuels, rating it the best biofuel Mother Earth can produce as it is carbon neutral, will grow on marginal land, needs no-to-minimal fertilizer or pesticides, can be harvested 2-3 times a year, and can produce fuel from both the seed and cellulose.

Economically, industrial hemp could greatly boost the economy in Belize as it has done everywhere it is grown, producing jobs in cultivation, processing, and marketing. A press release issued in the spring of 2017 by Vote Hemp, a US-based non-profit organization dedicated to advancing a free market for industrial hemp, low-THC oilseed and fiber varieties of cannabis, reported that annual retail sales in 2016 for hemp products were $688 million in the US alone from just food, body care products, medicines, and supplements with a 25% growth from the previous year.

Editor's Note: Hemp, grown under license mostly in Canada, is the most publicized "new" crop in North America. Popular Mechanics magazine (1938) touted hemp as "the new billion dollar crop," stating that it "can be used to produce more than 25,000 products, ranging from dynamite to Cellophane."

More information see Purdue University - https://www.hort.purdue.edu/newcrop/ncnu02/v5-284.html

Canning Tropical Fruits

By Deborah Harder

The potential abundance of fruit in our tropical climate creates a preservation paradox. You don't "need" to can fruit because with the right effort and planning, you can have some kind of fruit year-round, or nearly so. But when you really have lots of a certain kind, it's hard for the thrifty householder to see it spoil. So we can fruit, stockpiling for the winter that never comes. I have mixed feelings about canning, but I do it, and you can too if you want to.

The following directions are not USDA approved but are just how I actually do it. The amounts of sugar called for are low.

General directions using boiling water bath method

1. Start with washed fruit and clean jars that are not chipped or cracked.
2. Wash jars in hot soapy water, rinse well and let stand with hot water in them to warm the jar and prevent breakage when hot syrup is added.
3. Place metal sealing lids in pan with water to cover; heat to boiling and keep hot.
4. Peel and clean fruit in whatever way is needful. Cut into desired size pieces. Pack fruit in jars, tapping down but not pressing or squishing, leaving ½" head space.
5. Add sugar on top and then fill with water, preferably hot, filling to within ½" of top of jar. Run knife between fruit and jar to remove any air bubbles. Add additional water if necessary.
6. Wipe jar rims with clean cloth, double checking for chips or for food particles remaining that would prevent sealing.
7. Place new or nice, clean used lids on jars. Screw on ring bands with a woman's strength; men do it too tight.
8. Place filled jars on rack in a large canner of water (not boiling hot if you used cold water in jars), 1/3 full. Add additional hot water to cover jars; cover canner and bring to a boil.
9. Start counting the processing time when water begins to boil. Reduce heat to hold water a steady, but gentle boil.
10. See chart below for canning times.
11. Remove jars from canner and set upright, 2–3" apart, on a cardboard or padded surface (not a cold floor). Keep jars away from any draft which could cause hot jars to break.

Let cool overnight. Remove ring bands and check to be sure the top of lid is depressed.

A table of canning times: boiling water bath

FRUIT	PREPARATION PROCESS	MIN./QT.
Banana	Peel bananas and drop whole in jar. Do not add water or sugar. To use, mash and add to banana cake or muffins.	15
Carambola	Remove edges of lobes; cut lobes apart and remove membranes and seeds if desired. Cut fine and pack with water + 2 tbsp. sugar/qt.	10
Cashew Apple	Twist nuts off cashew fruit; wash and dice fruit. Pack with water + 2 tbsp. sugar/qt.	15
Craboo	Make sure craboos are ripe by letting sit for a few days. Wash and pack with water + 2 tbsp. sugar.	30
Grapefruit	Peel grapefruit and pull apart sections. Snip edge of each membrane with scissors and remove. Pack sections in jars, then fill with water + ½ c. sugar/qt.	10
Guava	Wash and halve guavas; remove all bad parts and scoop out middles with a spoon. Cut fine and pack with water + ¼ c. sugar/qt.	15
Jujube	Peel jujubes and cut fruit in chunks off from central seed. Pack with water and 2 tbsp. sugar/qt.	20
Malay Apple	Halve malay apples, remove seeds, blossom and stem ends. Dice or leave in halves; sprinkle with sugar and bake until colour changes. Fruit will then produce juice to be used as canning liquid.	15
Mango	Wash and peel fruit. Cut flesh to seed in ½" cuts, then slice off from seed. Pack loosely, being careful not to smash fruit. Add water + 1 tbsp. sugar/qt. Leave 1-1/2" headspace as mango tends to foam up. For the same reason, do not remove jars from hot water bath immediately, but allow kettle to cool for about ½ hr. first.	25
Mulberry	Wash berries and pack with water +1/4 c. sugar/qt.	15
Orange (juice)	Juice oranges. Pour into jars.	5

Book Review: The Energetic Goat
By Clarrie Eastman
Reviewed By Chris Harris

When we first began keeping goats in Belize it was something of a minority interest. We struggled to find goats to buy, and purchased virtually any goat that was offered to us; I think we only ever turned down two of them, which were very scrubby and too wild to handle.

Of course, we read everything we could get our hands on, and asked many, many questions of existing goat owners. Most people who had goats (with one or two exceptions) actually didn't know a great deal about them. They kept a doe for milk for the house, and that was about it. If she thrived, she thrived, if she failed, well, she was just a goat.

Facebook has a number of excellent groups - "Goating with Rosie" being one of the best – where goat owners can get help. However, much of the help does consist of Americans advising us to get the vet out. And our vets, bless them, are not experts in goats. (Even in the US, it's hard for people in many areas to find a goat vet.)

So self-help manuals for goat keepers are always of interest. "The Energetic Goat" is a self-help manual with a difference. It describes a system of alternative therapy for goats using reflex diagnosis, muscle testing and dowsing. So now some of you may throw this article down in disgust, and some will be reading on eagerly; it rather depends on your point of view.

Personally, I have an open mind about alternative therapies, but I am more likely to use them on myself than on my precious animals! Yet we once risked $10,000 to drill a well over a hundred feet below the earth based on a man who dowsed for the water source. Most of us know that dowsing for water works, so why not use dowsing for other things? After all, "There are more things in heaven and earth than are dreamed of in our philosophy," Shakespeare pointed out.

If you are interested in alternative treatment for goats, this book is a very good starting point. Clearly written with a minimum of mumbo jumbo, very nicely presented and with exceptionally clear photographs and diagrams; if you want to try these techniques for yourself, this is the book for you. Although the first half of the book is frankly a bit whacky, the second half which discusses nutrition and herbal remedies does seem to be sound. There is a particularly useful chapter on the health of the gut, and another on how to transition to holistic herd management.

Of course, "The Energetic Goat" suffers from the usual issue that we find in the tropics. The feeds recommended – oats, barley, alfalfa, etc. and the herbal products are simply an expensive dream for us. But this book is certainly an interesting addition to your repertoire of goat information, and a guide to how to reduce your use of chemicals in your herd.

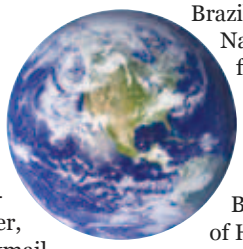
The Flight of the Bean
By Dottie Feucht

There they were! Growing next to a Chinese restaurant in Belmopan. Recognizing them as wing beans from his homeland, the Philippines, a friend asked for and received some of the cultivated beans and started growing them himself. When I was offered some to take home to start my own plants, I said, "Sure; why not? What's a wing bean? Originated in Papua New Guinea you say? Whoa.... Long way from 'home' these little beans are." They look like black-eyed peas without the black eye; theirs are light colored instead. The pod of the beans have four winged edges; hence the name. Like other plants that grow in many different countries it has many other names: winged bean, asparagus pea, Goa bean, four-angled bean, four-cornered bean, Manila bean, and dragon bean.

The winged bean (*Psophocarpus tetragonolobus*), an herbaceous perennial legume plant, grows as a vine with climbing stems and leaves to a height of 3–4 m, both taller and notably larger than the common green bean. The bean pod is typically 15–22 cm (6–8.5 in) long and has four wings with frilly edges running lengthwise. The skin is waxy and the flesh partially translucent in the young pods. When the pod is fully ripe, it turns an ash-brown color and splits open to release the seeds/beans. The wing bean thrives in tropical climates with warm weather, humidity and abundant rainfall. It is grown in Southeast Asia, especially in the Philippines and Thailand, and prolifically in tropical Africa and Hawaii. It is used most often as a vegetable in these regions. The pods pick up bold flavors of chilies, garlic and spices in sautéed Oriental dishes. In Sri Lanka and southern India, wing beans are most often used for pickling. In Myanmar and New Guinea, special cultivars are grown for their tuberous roots, which resemble mini sweet potatoes and have a nutty taste.

Wing beans have great potential in Belize as a multi-use food crop. They can be grown without added fertilizer as the plant has a bacterium on the nodules of the roots that fixes nitrogen and allows the plant to absorb nitrogen, making it a restorative crop for nutrient-poor soil; they are also an effective cover crop suppressing weeds. The entire winged bean plant is edible. The leaves, flowers, roots, and bean pods can be eaten raw or cooked; the pods are edible even when raw and unripe. Each of these parts contains vitamins A, B and C, calcium, and iron, among other nutrients. The beans themselves are similar to soybeans in both use and nutritional content (being 29.8% to 39% protein) and can even be used as an inexpensive food source for livestock, ruminants, poultry, and fish. In Papua New Guinea the husks are fed to pigs. I hope the "wings" of this plant are clipped and it stays and becomes a favorite in Belize as in other tropical countries.

AG BRIEFS



UB CF announces that the next **Neal Kinsey Soil Fertility 3 day course** will be held September 3rd - 6th, 2018. This will be a repeat of the very well-received Intro 2 Course given in February. To register, contact David Thiessen at 670-4817 or thiessenliquid@gmail.com. Limited registration.

The Belize Livestock Producers Association (BLPA) will hold their 2018 AGM on Saturday 24th March at their headquarters at Mile 47½ George Price Highway, Belmopan. For information phone 822-3883 or email <blpa@btl.net>

The 2018 National Agriculture and Trade Show (NATS) will be held on the NATS grounds on the 27th,28th & 29th of April, with the theme, "Let's Get Growing". For information about securing a booth etc, kindly call 623-0606 or email nats@agriculture.gov.bz

The **2018 Chocolate Festival of Belize** will be held in Punta Gorda Town, Toledo District, from Friday May 18th thru Sunday May 20th.

Many who were cattle ranching in Belize in the late 1980's/ early 1990's recall when the New World screwworm, *Cochliomyia hominivorax* was eradicated here by USDA and partners using the strategy of aerially dropping sterile male flies. This same technique is being used now in Israel, in effort to eradicate the damaging Mediterranean fruit fly. Breeding these sterile males flies with the resident females prevents new offspring from being born. This particular sterile insect technique application in Israel on approximately 35 dunams (8.7 acres) is estimated to replace the use of about 33,000 liters of chemical pesticides, which could contaminate land, waterways and people. The company producing these sterile flies by radiation and carrying out this biological pest management is Bio-Bee of Kibbutz Sde Eliyahu in Northern Israel. Further information: http://m.jpost.com/Middle-East/Why-is-Israel-scattering-millions-of-flies-around-Gaza-543569?utm_medium=email&utm_source=newsletter&utm_campaign=26-2-2018&utm_content=Why-is-Israel-scattering-millions-of-flies-around-Gaza-543569

Brazilian researchers of Sap Paulo State's National Institute of Science & Technology for Semiochemicals in Agriculture, have identified the sex pheromone of the Asian citrus psillid (ACP; *Diaphorina citri*). This is landmark news, as this insect is the vector for the bacteria causing HLB, aka citrus greening disease. The research arm of Belize Citrus Growers Association (CGA) confirmed presence of HLB in country in the last decade; HLB has wreaked havoc on the local industry. This new discovery makes it possible for traps to be utilized with this synthesized pheromone. More information: https://www.sciencedaily.com/releases/2018/02/180207140432.htm

Florida's 2017/2018 citrus crop predictions are for a crop 35% down from previous. Brazil's past harvest was estimated at a 57% increase over the previous year's dismal yields. Brazil does not expect this increase to continue to their next crop. Belize is suffering from lowered yields due to HLB. Higher prices in the past few years still do not compensate adequately for the local losses in yield.

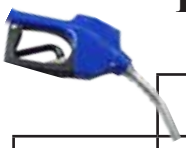
For Information on the status of the

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	↑$10.28 Bz/Gal	↑ $8.57 Bz/Gal	↑ $8.57 Bz/Gal
PREMIUM	↓$11.34 Bz/Gal	↑ $7.44 Bz/Gal	↓ $7.44 Bz/Gal
DIESEL	↑$10.11 Bz/Gal	↑ $6.99 Bz/Gal	↑ $6.99 Bz/Gal

In **January 2018 the Food and Agriculture Organization of the United Nations (FAO) estimated that "approximately one third of all food produced for human consumption in the world is lost or wasted" – an annual loss of 1.3 billion tons.** Interesting but not surprising is that in the less developed countries the losses are more from "unintentional wastage (about 40% occurring post-harvest or during processing) – due to poor equipment, transportation and infrastructure". However in the wealthier developed world, much lower levels of 'unintentional waste' occur but high levels of waste (est. 40%) occur by "food being thrown away by consumers because they have purchased too much and also by retailers… [who] reject food because of exacting aesthetic standards".

The London Fruit company opines that there is a worldwide **explosion of interest and consumption of jackfruit** (Altocarpus heterophyllus). Although the fruit is native to Vietnam and Thailand, they source their jackfruit from Mexico. The size of the fruit varies from 10 to up to 100 pounds per (!) so most retailers sell it pre-cut. Global food media are learning and sharing more ways to consume this including as a meat substitute.

Spanish Lookout's Friesen Hatcheries was featured in the top online poultry newsite, thepoultrysite.com, **describing their upgrade to single stage incubation**. General manager Edward Dueck states: "Our company, Freisen Hatcheries has been producing layer and breeder flocks in Belize since 1966. We have our own parent breeder broilers and brown layers. Our latching eggs come from internationally recognized companies in the USA such as Hubbard, Arbor Acres, Cobb and NOVOGEN……" Their improvements also include 'Embryo-Response Incubation™ Technology, OvoScan™, which ''adjust the temperature of the embryo environment by controlling the egg shell temperature", minimizing mortality and improving post-hatch performance. http://www.thepoultrysite.com/poultrynews/39765/friesen-hatcheries-first-hatchery-to-adopt-single-stage-incubation-in-belize/

ACS Biomaterials Science and Engineering published a study by McMaster University researchers about a **food wrapping which kills bacteria including those which contaminate foods** and cause food-borne sicknesses. The wrapping does this by incorporating viruses which target specific strains of bacteria (not killing all types as antibiotics do) into the wrap itself. The product is said to be effective for up to 3 months and does not alter the taste, smell or appearance of the fruits and vegetables.

Mexican researchers from the Autonomous University of the State of Hidalgo (UAEH) are in the process of patenting a disinfectant solution for avocadoes, in which one of the key ingredients is hibiscus flowers. The"Creole and White varieties [of hibiscus] have a higher concentrations of hibiscus acid which exhibits strong antimicrobial properties against strains of salmonella, typhoid and E. Coli in avocado". The flower's ingredients are mixed with acetic acid (vinegar) or other citric acid (lime) for a formula which completely eliminates these pathogenic bacteria from avocadoes – outperforming many other natural formulas marketed such as colloidal silver or chlorine. Mexico grows 30% of the world's avocadoes, making her the world's leading producer and exporter.

UCLA researchers Leigh Hopper and Dr. Gary Small's recent study included in January in the *American Journal of Geriatric Psychiatry*, shows **that in addition to curcumin's (found in the spice turmeric, aka yellow ginger) better known anti-cancer and anti-inflammatory properties, it also "improves memory and mood in people with mild, age-related memory loss"**. Dr. Gary Small of UCLA's Longevity Center opined that this may be due to "its ability to reduce brain inflammation, which has been linked to both Alzheimer's disease and major depression". In the tests, the participants were given either placebo or 90 milligrams of curcumin twice daily for 18 months. Those receiving the curcumin had a 28% improvement in memory tests and some had mild improvements in mood. More research is needed to explore curcumin's antidepressant effects. It was noted that India, where turmeric (curcumin) "is considered a dietary staple has a much lower prevalence of Alzheimer's disease and [seniors have] better cognitive performance".

Research in Ecuador, published in *Postharvest Biology and Technology* in January 2018, revealed that diluted **thyme oil sprayed on bananas reduced the incidence of anthracnose, a fungal pest.** There were no adverse affects to the weight, odor or taste of the bananas from essential thyme oil application, suggesting that this would be a viable treatment for organic bananas.

A Dutch company, **Bird Control Group https://birdcontrolgroup.com offers a laser solution for farms suffering high losses from hungry birds**. The company states that the birds "perceive the laser beam as a predator… and fly away seeking protection". Agrilaser Autonomics are often placed along the edges of farms or fields. It is claimed that birds will not become accustomed to this system, and that it retains its effectiveness. Bird Control Group operates in over 75 countries, for 1,600+ companies and includes applications for the agricultural, aviation, industrial and real estate sectors.

Mexican coconut producer and exporter to the US, Fresco Produce LLC reports that coconut sales have increased to 5 to 10 times in the last 5 years and still there is **more demand for coconuts and value added products than are available**. Price increases have been slow but stable. World consumer trends indicate the demand for healthy coconut water, oil, milk, meat and their use in processed items will continue to grow.

The *Belize Ag Report* learned from *Acres USA* magazine, of an excellent online source of agricultural information, the ATTRA Sustainable Agricultural Program, managed by the National Center for Appropriate Technology (NCAT) out of Butte Montana since 1987. See this link for a PDF on **Cover Crop Options for Hot and Humid Areas IP535 .** Most downloads are free, as is this one. https://attra.ncat.org/attra-pub/summaries/summary.php?pub=570

sole energy source. They live in a wide variety of habitats, including surface soils. If a cow has her head down eating grass, the methane she breathes out is rapidly metabolized by methanotrophs. There's an analogous situation with termites. Termites produce methane during enteric fermentation, as happens in the rumen of a cow. But due to the presence of methanotrophic bacteria, methane levels around a termite mound are actually lower than in the general atmosphere. In nature, everything is in balance. After the disastrous Deepwater Horizon oil spill in the Gulf of Mexico, the ocean was bubbling with not only oil, but also methane. To the astonishment of scientists monitoring the spill, populations of methanotrophic bacteria exploded and consumed an estimated 220,000 metric tons of methane gas, bringing levels back to normal.

ACRES U.S.A. When we talk about the consequences of the increased extreme weather associated with climate change, like devastating floods and droughts, all too often we neglect to consider how better land management can reduce their impacts.

JONES. With weather events becoming more extreme our farming systems need to be more resilient. Again, this is where having carbon sequestered in soil to maintain aggregate stability and improve infiltration is vitally important. If we look at flooding on the Mississippi, for example, we see that the mean maximum and mean minimum water levels from the early 1800s to the present show an increasing perturbation since the dust bowl era of the 1930s. That is, the highs are becoming higher — floods are more severe — and the lows are getting lower — the river doesn't 'run' as much as it used to. This boom-bust situation is due to inappropriate land management. If soil is in good condition, water infiltrates rapidly and is held in the soil profile. Some of this water is used for plant production and some will move downward through the soil to replenish the transmissive aquifers that feed springs and small streams, enabling year-round, moderated base-flow to river systems. If groundcover is poor and soil water-holding capacity is low, rapid run-off not only leads to flooding in lower landscape positions, but also takes a lot of topsoil with it. These days it's not just soil, but a heap of chemicals too — which end up in the Gulf of Mexico.

ACRES U.S.A. Causing the Dead Zone?

JONES. Yes. The consequences are enormous. And when the flood is over, the river level drops because the transmissive aquifers haven't been recharged.

ACRES U.S.A. Is adding compost to the soil sufficient to turn things around?

JONES. Compost is certainly a fantastic product, but compost alone is not enough. It will eventually decompose, releasing CO_2. However, the application of compost to appropriately grazed pastures or polyculture crops can increase plant growth and photosynthetic rate, resulting in more liquid carbon flowing to soils. Diverse microbial populations — particularly fungi — supported by the compost, can aid in humification, improving soil structure, water-holding capacity and nutrient availabilities. On large agricultural holdings such as we have in many parts of Australia, it is not economically viable to spread compost. However, compost extract, which is simply the chemical signature of compost, can prove highly beneficial. The use of natural plant or seaweed extracts as biostimulants is a relatively new but rapidly expanding area of R&D and farmer-adoption worldwide. The advantage of biostimulants is that they function at very low rates of application — milliliters per hectare — as opposed to a product such as compost which needs to be applied in tons per hectare. These products stimulate soil biota and enhance plant root function. The proliferation of roots is quite obvious when you dig in the soil. There can also be rapid improvements in soil structure.

ACRES U.S.A. Your orientation is extraordinary. I'm wondering if at a certain point in your life, the way you saw the world underwent a radical change.

JONES. I've always been in tune with natural rhythms. I grew up in a little log cabin in what Australians call the bush. Here in the States you might call it wilderness. On one side of our cabin there was a big lake. An estuary joined the lake to the ocean, so there was water on three sides. The fourth side was a forest filled with all kinds of intriguing plants and animals. I was very much a child of the earth. My dad said I had my own veggie patch when I was only two. By that stage I could also apparently catch more fish than him. I just seemed to know where the fish would be and what they wanted to eat and what time of day they would be feeding. I was unaware that humans over-consume resources and pollute the environment until we moved to the city when I was about eight years old. I cried myself to sleep every night because, for me, it was paradise lost.

ACRES U.S.A. Did you study soils because you loved to grow things?

JONES. At school I became very interested in economics and planned to do an economics degree. Out of the blue I was offered a scholarship to study textiles. My first full-time job after graduation involved research into the parameters of wool that affect processing performance. Unless wool fibers have an even diameter all the way along their length — and high tensile strength — they break easily and are difficult to spin into yarn. Wool quality is influenced by pasture quality, which in turn is affected by soil quality. In a roundabout way I became interested in the linkages between soil health, plant growth and animal production. I undertook a Ph.D. in soil biochemistry to better understand how plants communicate with soil microbial communities. There haven't really been any light-bulb moments; it has been an ongoing process of discovery, finding the miraculous in the common.

For more information about Dr. Christine Jones visit www.amazingcarbon.com

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