The Prospects of Crop Diversification

Slide 1 - Presenter

Slide 2 - Goals

I am going to discuss the history of crop diversification in Barbados very generally and then look at a possible crop option for the future.

When I was first involved in planning the mantra was "if you do not know where you are going – any road will get you there. It did not take planners very long however before they realized that there was something else needed to properly plan. Can anyone tell me what that was? "If you do not know where you are and how you got there – any road might also do!"

Slide 3 - Definition

So, I am defining crop diversification as:

"the addition and/or expansion of new crops or cropping systems to agricultural production"

I joined the Barbados Ministry of Agriculture in July 1966 and in my first week of service I was instructed to attend a meeting of Ministry staff with a team of visiting consultants who were studying the Agricultural industry in Barbados.

That team of consultants informed us that agriculture in Barbados was a mono crop culture and needed to be diversified. Essentially, they said that the Barbados economy had all its eggs in one basket and was too exposed to the vagaries of the world market and unexpected events or changes that could not be controlled and would influence the sugar market. They proposed that Barbados diversify its sugar industry to other crops but could not say what those crops should be.

Slide 4 – Barbados Agriculture

At that time about 65,000 acres of land was being cultivated in Barbados. 45,000 acres of this was in sugar cane and the other 20,000 acres in food crops and vegetables which farmers had started to include in the sugar crop rotation. There was also some forage pastures for the fledgling dairy industry.

Barbados Agriculture 1966

Category	Area (acres)
Arable land	65,000
Sugar Cane	45,000
Other Crops	20,000
Total crops	65,000

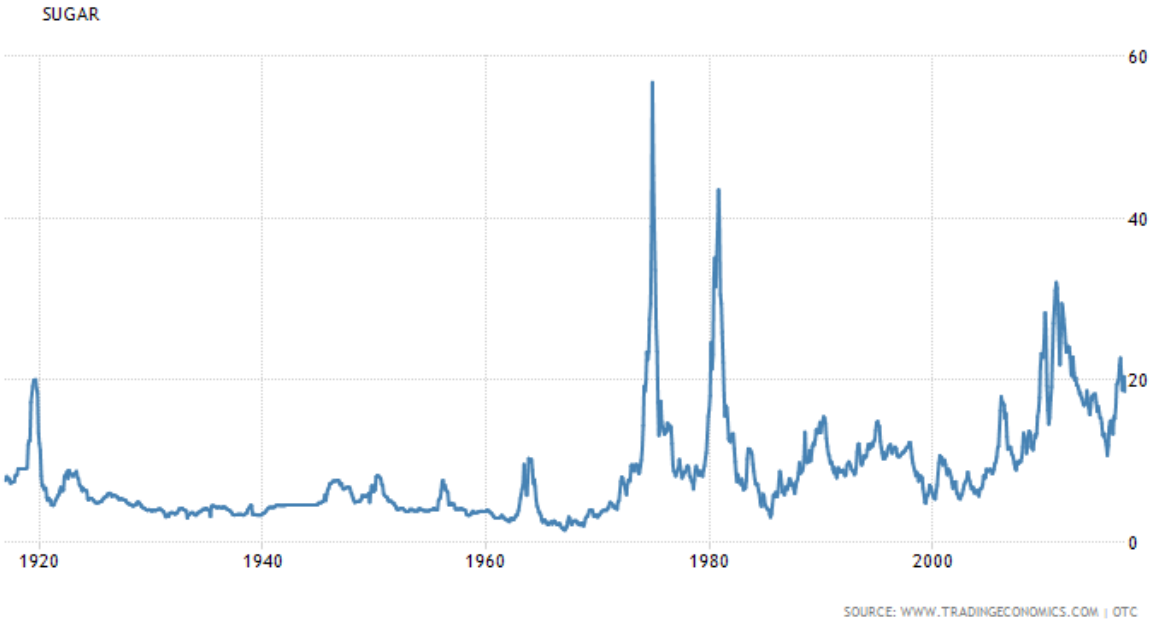
I should also point out that the strenght of the Barbados sugar industry at the time lay in its low capital cost and high efficiency. At the time the cost of processing the cane in Barbados was less

than 30 % of total costs while it was close to 50% in the rest of the world. By comparison it is now well over 50 % in Barbados.

In Barbados at the time the processing plants were old yet efficiently run by management and skilled staff. The capital cost of our processing plants had long been written off.

Yet the Barbados sugar industry appeared to be struggling economically. The world market was generally over supplied and prices were normally depressed. The industry was losing money on a regular yearly basis. However, every six to eight years there would be a significant price increase when international sugar production would fall below demand with a resultant price increase for Barbados sugar. This "wind fall" allowed sugar producers in Barbados to pay their debts and recapitalize the industry.

Slide 5 – Historical Sugar Prices (US cents per Lb)

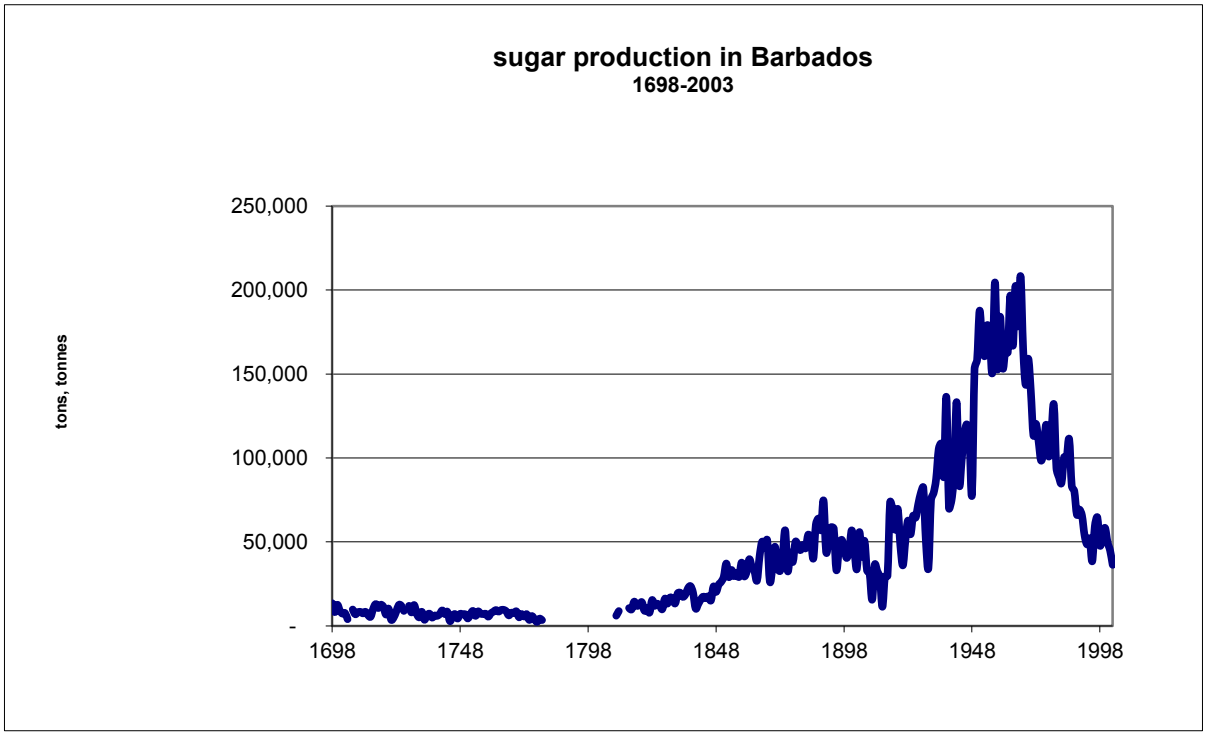


Such wind falls also boosted the economy as a whole. The wind falls in 1947, 1948 and 1950 for example allowed the Government to build the BD$5 million Deep Water Harbour in 1955. They do not look anything as big as, the "wind falls" of 1974 and 1981 which yielded the Government more than $50 million in taxes that are equivalent to more than one billion dollars today, but those windfalls amounted to nearly 70% of the total earnings in each of those years. As did those of 1957, 1963 and 1964.

Slide 6 – Sugar Production

The economists however could not leave "well" alone. I always remember president Reagan describing economists as "people who see something working in reality but still question whether it would work in theory". However our "hind sight is 20/20 vision". Look at Barbados sugar production record and you will see the subsequent jumps in production following the "wind falls".

Historical Production of Sugar in Barbados



Can anyone tell us what was wrong if anything with that proposal for crop diversification?

1. Sugar was not truly a mono crop as good agronomic management required that it be rotated with other crops which in Barbados were food crops and cotton;

Slide 7 – Economies of Scale

2. Introduction of other crops had to be done at the expense of sugar reducing the amount of sugar produced and thereby reducing the economies of scale and increasing the unit cost of production such economies of scale are crucial in a small country such as ours; "Economies of scale" is the cost advantage that arises with increased output of a product. Economies of scale arise because of the inverse relationship between the quantity produced and per-unit fixed costs; i.e. the greater the quantity of a good produced, the lower the per-unit fixed cost because these costs are spread out over a larger number of goods.
   In the sugar industry both capital and administrative costs are "fixed" so that a reduction in production increases the per unit fixed costs.

The International Society of Sugar Cane Technologists in 2008 identified the smallest financially viable sugar industry in the World as being 12,000 hectares or 30,000 acres with one cane processing unit (factory). The implication being that anything smaller does not have the necessary economies of scale. That is why the proposal for a new sugar factory in Barbados at this time is without any financial or economic justification.

3. The economic problem in Barbados was that we had a mono industry (agriculture) we needed to diversify to other industries not to diversify our agriculture;

4. There was no other crop that could be grown on the scale of sugar cane that would gross the same foreign exchange earnings;

5. Local crop markets are too small to afford adequate economies of scale on their own; and

6. All other potential export crops encountered the same vagaries of the world market and unexpected events or changes that could not be controlled and would influence the market price. Essentially there was no better alternative.

Crop Diversification was probably the worst possible agricultural policy ever imposed on Barbados as it helped to destroy the financial viability of the sugar industry without having anything to replace it. What will happen to sugar going forward is anybody's guess.

The only positives related to the sugar industry is the future potential of rum and the understanding that bona fide Barbados rum cannot be made from imported molasses. Given the present economic crisis the Government is unlikely to be able to continue supporting the sugar industry financially especially if it continues to be managed by civil servants. The only financially viable operations throughout the World are privately run and associated with rum production and sales wherein the rum has helped to subsidized the sugar production.

All of this is history but in going forward we need to know where we are and how we got here before we can determine where we want to go.

Current Context

In planning the future of our agriculture we also need to be aware of what is happening in the World around us in terms of production and consumption i.e. Supply and Demand and to remember that the only constant in life is change.

Slide 8 – World Population

One of these ongoing changes is the growth in World population and consumption. The former doubling from:

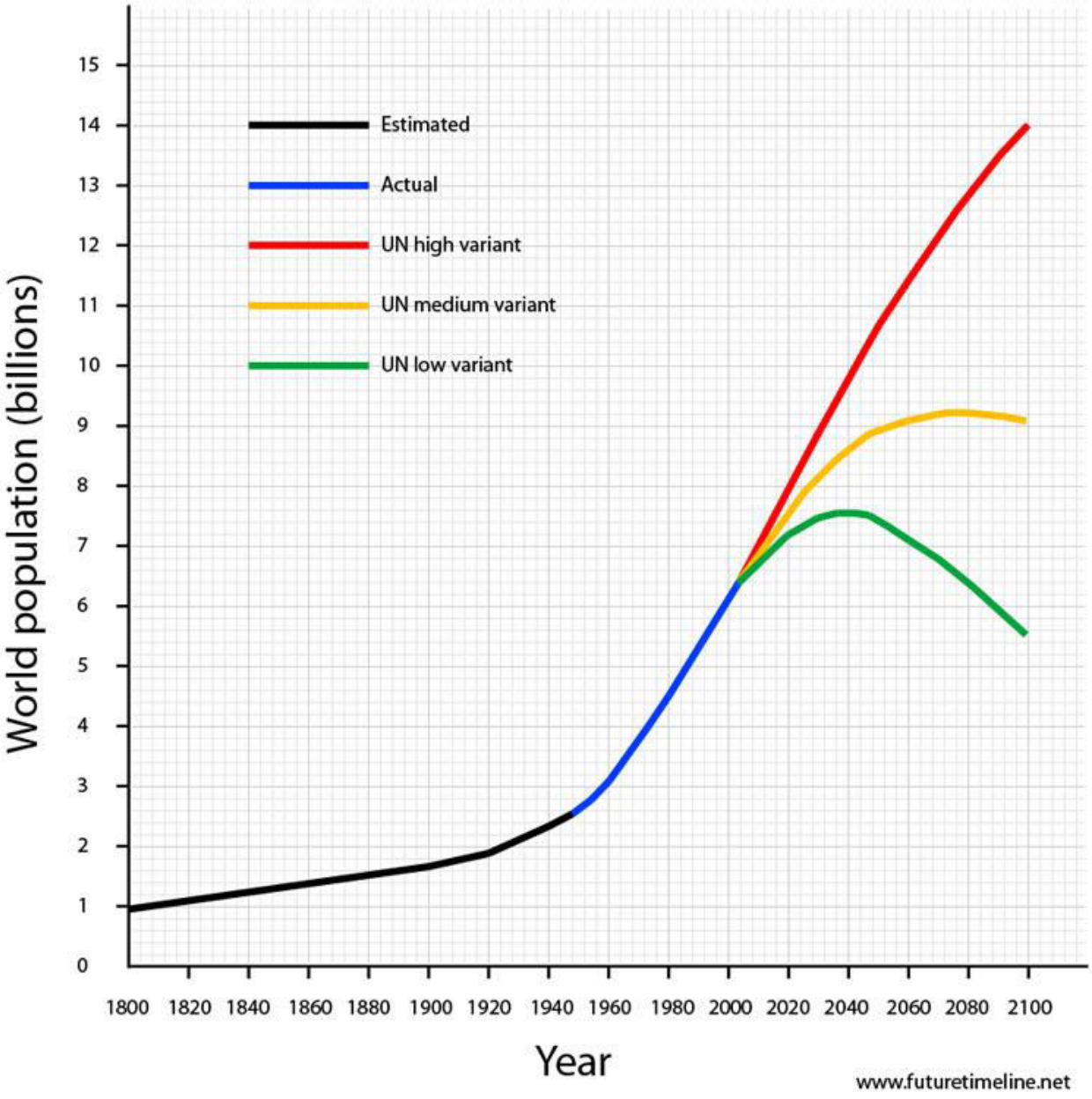
1billion to 2 billion in 120 years - 1805 to 1925

2 billion to 4 billion in 50 years - 1925 to 1975

4 billion to 8 billion in 47 to 53 years – 1975 to 2022 or 2028

This means that we still have a couple of billion or 30% more to increase before the World population peaks according to the UN median variant and that is in doubt.

World Population Growth

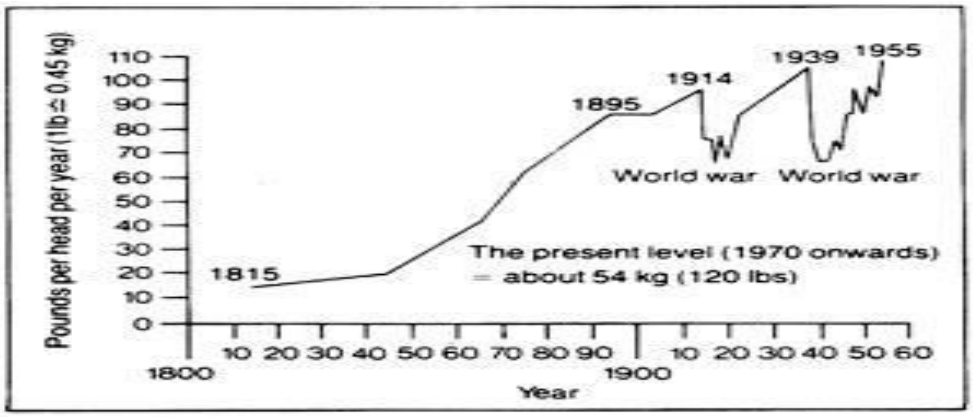


Slide 9 – Sugar Consumption per capita

Increased consumption means increased demand and increased demand means increased production and increased production means increased costs because the World has essentially run out of new lands to cultivate. To increase production on existing land means new improved technology which comes with a cost.

In Barbados our population has increased by about 15% over the last 40 years and food consumption has increased by more than that as our per capita earnings has also increased.

At the same time average per capita consumption of sugar (for example) in the World has increased from about 10 lbs per head in 1810 to nearl 110 lbs per head in 1955 and it is now estimated to be close to 120 lbs per head.



Slide 10 - World Sugar Consumption

As a result World sugar consumption doubled from just over 50 million tons in 1960 to over 100 million tons in 1987 and is currently close to 170 million tons per annum this increased consumption applies to almost all crops

Slides 11 & 12 – Barbados Crop Production

Table 1 - Barbados Crop Production

Crop	2008 (000 Kgs)	2009 (000 Kgs)	2010 (000 Kgs)	2011 (000 Kgs)	2012 (000 Kgs)	2013 (000 Kgs)	2014 (000 Kgs)	2015 (to Sept) (000 Kgs)
Bean	167.76	170.28	200.32	226.92	219.18	112.30	109.21	84.60
Beet	28.95	51.95	28.32	48.26	28.90	34.48	23.66	41.57
Cabbage	437.49	254.33	53.79	261.05	261.21	181.80	322.68	248.17
Carrot	252.82	198.12	225.83	145.66	244.48	295.48	310.24	235.60
Cassava	466.16	690.53	192.92	265.89	219.88	1,035.18	552.90	253.83
Cauliflower	3.21	1.98	0.67	0.71			14.29	2.32
Corn	180.62	71.18	86.54	22.61	80.96	17.55	81.79	96.28
Cucumber	811.63	1,119.70	1,061.48	1,102.83	816.3	823.89	994.26	494.16
Eddoe	40.46	23.48	26.95	18.89	65.27	175.60	74.61	121.34
Egg Plant	77.20	28.34	54.30	53.15	27.57	17.44	41.9	156.09
Lettuce	143.64	572.05	53.60	84.81	171.02	213.30	312.72	357.29
Okra	423.61	244.56	282.17	294.57	262.10	220.62	263.63	204.00
Onion	333.21	625.96	379.95	319.87	550.12	503.83	315.24	748.10
Peas	24.98	29.15	57.90	19.43	20.30	58.36	25.29	35.00
Peanut	23.70	50.42	9.51	4.63	18.50	87.31	4.62	7.93
Pepper (hot)	124.41	178.14	74.76	81.77	64.74	48.16	92.81	60.96
Pepper (sweet)	220.88	293.85	307.59	314.33	175.06	493.64	396.32	203.35
Potato (sweet)	884.01	1,202.24	774.37	341.65	1,202.46	1,220.11	1,231.89	878.96
Pumpkin	249.33	191.22	155.77	145.35	188.49	533.01	508.19	249.10
Squash	292.85	565.47	671.04	779.61	698.44	495.64	562.08	227.69
Tomato	815.36	718.54	691.69	809.63	1,050.35	989.26	781.03	570.17
Watermelon	185.13	243.10	220.61	132.83	191.14	381.63	318.84	300.00
Yam	279.61	824.29	453.41	196.19	348.05	748.91	567.13	537.00
Bonavise	0.77	0.24	0.15	0.23	0.63	0.02	0.54	15.39
Eschalot	0.30	3.29			1.69	1.60	0.52	0.25
Christophene	78.13	6.46	6.46	0.10	3,021.62	40.84	0.64	0.00
Chive	235.29	144.40	92.44	22.70	721.67	564.89	159.66	386.80
Thyme	197.55	126.97	235.48	17488	277.37	122.18	59.90	30.40
Marjoram	36.74	6.14	3.21	268.62	144.67	17.67	38.92	53.29
Celery	0.28	3.52				3.50	0.49	0.00
Parsley	33.99	21.58	57.43	0.40	171.77	73.70	27.57	16.74
Broccoli	2.97	2.96	1.99	5.62	0.15	0.05	0.13	0.13
Cantaloupe	39.50	1.19			3.40	154.51	148.64	92.47
Seasoning	11.01	27.89	77.33	3.71	14.86	1.53		
Dill	3.40	2.12	2.55	37.73		0.10		0.02
Basil	0.13	11.18	1.19	13.84	816.47	13,502.45		136.08
Paw Paw	5.66	14.17	311.84	0.20	85.21	325.35	76.54	32.10

Chin Cabbage	42.89	1.28	9.78	147.41	63.60	72.27	91.52	97.43
Runcifers	0.41	40.19	0.10	26.80	0.01	0.01	2.94	10.18
Bananas		5.48	7.97	1.01	39.36	478.47	225.17	44.22
Plantain		51.35	11.61	0.11	6.94	518.69	435.45	73.21
TOTAL	**7,156.22**	**8,820.93**	**6,891.11**	**6,413.05**	**11,470.15**	**11,250.51**	**9,197.63**	**6,989.49**

Source: Ministry Of Agriculture

Barbados food crop production currently amounts to over 10,000 tons annually, but we are still importing over 9,000 tons or almost half of what we consume

Slide 13 – Vegetable Imports

Table 2 - Vegetable Imports (2008 – 2012)

Vegetable Crop	2008 (000'kg)	2009 (000'kg)	2010 (000'kg)	2011 (000'kg)	2012 (000'kg)	2015 (000'kg)
Bananas	?	?	?	?	?	3,170.25
Beans (string)	0.12	0.11	0.05	4.89	0.59	0.71
Beet	20.60	22.90	29.84	31.26	32.95	0.10
Cabbage	416.50	426.20	508.65	468.77	411.63	783.34
Carrots	444.90	898.70	707.04	679.87	629.85	625.73
Cucumber	9.80	45.50	48.84	100.06	30.96	13.19
Lettuce	305.30	470.50	548.81	576.98	606.01	304.80
Watermelons	445.40	473.20	664.77	617.69	543.24	426.48
Okra	0.01	0	0.13	0	0.07	0
Peppers (hot)	23.00	2.70	2.99	36.54	16.89	0
Peppers (sweet)	77.30	102.70	108.89	170.78	152.96	187.01
Plantains	?	?	?	?	?	1,374.50
Pumpkins	548.60	673.10	446.96	536.14	340.62	173.21
Tomato	138.60	91.90	240.85	181.31	163.08	245.58
Total Vegetables	**2,430.13**	**3,207.51**	**3,307.82**	**3,404.29**	**2,928.85**	**7,304.90**

Source: Barbados Statistical service/ Ministry of Agriculture, Food, Fisheries and Water Resource Management

Slide 14 – Root Crop Imports

Table 3 - Root Crop Imports (2008 – 2012)

Root Crop	2008 (000'kg)	2009 (000'kg)	2010 (000'kg)	2011 (000'kg)	2012 (000'kg)	2015 (000'kg)
Cassava	1.80	3.40	0.73	3.50	1.67	0
Eddoes	115.10	63.70	86.31	106.34	106.14	76.23
Sweet Potato	36.40	1.00	9.99	2.34	24.59	11.09
Yam	20.70	8.60	22.69	25.22	33.73	84.09
Onion	1,922.90	2,064.40	2,026.63	2,212.69	2,169.33	1,715.65
Peanut	71.40	41.50	61.19	111.05	9.03	0
Total Root Crops	**2,168.30**	**2,182.60**	**2,207.44**	**2,461.14**	**2,344.49**	**1,887.06**

Source: Barbados Statistical service/ Ministry of Agriculture, Food, Fisheries and Water Resource Management

Looking to the future the food crops that have stand out potential for increased production in Barbados where we are not meeting the current demand are:

1. Bananas of which about 85% of current consumption is imported or over 3,000 tons per annum;
2. Plantains of which about 75 % of current consumption is imported or over 1,300 tons per annum
3. Cabbage of which about 70% of current consumption is imported or over 700 tons per annum
4. Onions of which about 70% of current consumption is imported or over 1,700 tons per annum;
5. Carrots of which about 65% of current consumption is imported or over 600 tons per annum;
6. Water melon of which about 60% of current consumption is imported or over 400 tons per annum;
7. Lettuce of which about 50% of current consumption is imported or over 300 tons per annum; and
8. Pumpkin of which about 50 % of current consumption is imported or over 300 ton per annum;

Essentially we can increase our production by up to 9,000 tons per annum purely for the local market.

In terms of cost we cannot produce these crops cheaply simply because there are no economies of scale especially in terms of input supply. All inputs except for labour cost twice as much as they do in the USA. So we either bite the bullet and support our farmers or bankrupt our country by importing everything and our politicians more than anyone else need to understand this.

These imports are a shame for our country because they are using scarce foreign exchange to compete with our farmers who have the capability of producing almost all of our fresh food crop needs.

COCONUTS

The other crop with potential which I am going to focus on here is the Coconut.

Slide 15 - Coconut

The **coconut tree** (Cocos nucifera) is a member of the family Arecaceae (palm family) and the only species of the genus Cocos. The term **coconut** can refer to the whole **coconut** palm or the seed, or the fruit, which, botanically, is a drupe, not a nut.

A drupe (or stone fruit) is an indehiscent fruit in which an outer fleshy part surrounds a shell (of hardened endocarp with a seed inside. Indehiscence means not splitting open to release the seeds when ripe.

Slide 16 – The Tree of Life

Because of its many uses and importance as a food source the Coconut is known as the "Tree of Life". In the not too distant past coconut products were frowned on as cholesterol promoting, fat inducing food. However recent research has shown that coconut oil is a saturated fatty acid but a medium chain fatty acid that is readily metabolized in the body unlike most of the other longer chain, saturated fatty acids in other vegetable and animal fats. This new research has resulted in sky rocketing demand worldwide for coconut products.

Slide 17 – Coconut Meat Copra

<u>There are many products and Uses of Coconut Tree</u>:

1. Copra is the dried kernel or meat of the coconut from which coconut oil is expressed. It contains over 60% oil. This oil is used in making soap, cooking fat, margarine, cosmetics, lubricants, and many other products.

2. Copra can also be shredded or flaked for use in baked goods or candies.

3. Another product is Coconut Oil

Slide 18 – Coconut Oil

Coconut oil is an edible oil that is extracted from the meat of the coconut. There are two main processes for extraction of the oil: dry and wet.
The dry method is the classic technique, which involves using fire or sunlight to dry coconut meat extracted from the shell, resulting in what is known as copra. This copra can then be pressed in order to

squeeze out the oil, or dissolved with solvents. Either way, the result is coconut oil plus a mash rich in fiber and protein. Although simple and straightforward, the dry process does lose oil along the way.

The wet process uses the raw coconut instead of the dried copra, but it has to deal with the problem of separating the oil and the water inside the coconut, which are mixed together through emulsion. Original wet process techniques involved boiling the coconuts, but this resulted in a lot of wasted materials and discolored oil. Modern methods rely on centrifuges in order to separate the two substances, along with pre-treatments that use acids, salts, or heat. Despite their relative versatility and sophistication, wet processes are still not as efficient as dry ones and result in a lower yield and the higher amounts of energy and time involved.

'Virgin' coconut oil, means that it has been processed without the use of chemicals or solvents. You can make your own virgin coconut oil in your kitchen quite easily. There are several U-tube videos that demonstrate how to do so.

Slide 19 – Coconut milk

4. Another product is Coconut Milk

Coconut milk should not be confused with coconut water, as they are two completely different things. For starters, coconut water is clear and coconut milk is white. They are also obtained in different ways.

While coconut water is simply the liquid found in the interior of the coconut, the milk is made by grating the meat of a mature coconut. Due to the high oil content of the coconut meat, the end result is coconut milk full of saturated fats and rich in taste and color.

Don't confuse real coconut milk, which is usually found in a can, with the coconut-based milk substitutes found next to soy milk in your supermarket. These milk substitutes usually contain carrageenan and a variety of unhelpful additives and preservatives.

Various preparation methods allow for coconut milk of varying fat percentages, ranging anywhere from 22% to 5% fat. High-fat coconut milk is traditionally obtained by grating coconut meat and squeezing it through cheesecloth. In order to decrease the fat percentage, the coconut meat is left to soak in warm water and then the process is repeated two or three times. It is also possible to make your own coconut milk at home. There are several Utube videos demonstrating this.

Slide 20 – Coconut butter

5. Coconut Butter

Coconut butter makes use of the meat of the coconut in order to achieve a thick, solid paste that has a similar texture to other traditional butters and is frequently used in cooking.

There are several straightforward ways to make coconut butter, all using shredded and dried coconut, but the easiest one is simply to blend it. This can be done with a high-powered blender or a food processor. If the end result does not have the consistency of butter, some coconut oil can be added to the mixture (see the recipe below).

Coconut butter is used almost exclusively in cooking. It is often used as a substitute in recipes that call for coconut oil, but can also be added to curries, mashed vegetables, smoothies, and more. Many recipes that call for coconut butter are dessert recipes, although there are plenty of other dishes that can benefit from its flavor. It is full of healthy fats and vital nutrients such as magnesium and calcium so many people will even eat it on its own.

4. Coconut cake, the solid material left after the oil is removed from the copra, is used in making cattle feed and fertilizer.

Slide 21 – Coconut Water

Coconut water is the liquid found inside coconuts and, although high in natural sugars, is highly regarded for its rich nutritional value. This natural juice is packed with minerals such as iron, calcium and magnesium, multiple B-complex vitamins, bioactive enzymes, electrolytes, and cytokinins.

Research has shown that coconut water has a similar effect as sports drinks in rehydrating the body after strenuous exercise or the fluid loss resulting from gastrointestinal issues such as diarrhea. The micronutrients in coconut water help boost the immune system. The plant hormones called cytokinins in this health drink exhibit anti-aging, antithrombotic and anticancer effects. Plus, the potassium in coconut water helps improve the crucial sodium balance in the body.

It is important to note also that tender coconut water has more nutrients than mature coconut water. This is something that our current industry does not recognize.

Although all coconuts contain this liquid, it is typically only the slightly immature ones (between 5 and 7 months of age) that are harvested for this purpose. Younger coconuts have water which is bitter and not yet rich in nutrients, while older coconuts do not have as much water as immature ones. If harvested at the most opportune time, a coconut can have as much as one liter of water inside it. We find in Barbados that the nuts average half a litre of water.

Slide 22 – Coir Rope

7. Fiber from the coconut husk is used to make mats, brushes, cordage and packaging material for plants, and in some countries, coconut husk is used as floor polisher.

Slide 23 - Shell Baskets

8. The shell is used for ladles and cups, and is polished and ornamented into souvenirs, accessories and decorative objects.

9. Young leaf shoots may be eaten as salad.

10. The sap, a sweetish fluid called toddy, is fermented into an alcoholic beverage or into vinegar.

Slide 24 – Rood Thatching

10. The leaves of the tree are used to thatch roofs and to make hats, baskets, and fans.

11. The trunk is used for canoes, posts, rafters, timber and fences.

Slide 25 - Energy

12. The shells and other wastes can be burnt for energy

14. Finally, we can also use the coconut palm heart or "poor man's caviar" which is worth as much as Bd$20 per lb. from some executive chefs. This is the growing point of the tree and to harvest this you need to kill the tree. It is not therefore a sin to cut down a coconut tree the sin is if you cut down a coconut tree and not harvest the heart. Again there are several Utube videos demonstrating how to harvest the Coconut palm heart.

Please note that I have just identified some of the primary coconut products There are also many cosmetics and food flavorings made from the coconut.

Slide 26 – Coconut Production

Around ninety per cent of total world coconut production occurs in the Asia Pacific region. In terms of production by weight Barbados is currently ranked 80th in the world. According to these statistics we have in the region of 15,000 trees or about the equivalent of 150 acres with 100 trees per acre. Puerto Rico at 61.5 tons per acre has the highest yield in the region.

Table 4 - Coconut Production (Tons) 2014

Country	Tons	Ranking	Average yield (Tons/acre)	Nuts per Tree
World	60,511,756		19.9	99
Indonesia	18,300,000	1	23.8	118
Philippines	14,696,298	2	16.5	82
India	11,078,873	3	20.4	102
Brazil	2,919,110	4	45.9	228
Dominican Republic	333,630	16	26.8	133
Jamaica	240,111	21	23.5	116
Guyana	77,748	30	17.6	88
Cuba	63,261	36	15.8	79
Trinidad and Tobago	22,095	47	30.7	153
St. Lucia	13,010	55	19.4	97
Suriname	12,880	56	46.1	229
Dominica	7,917	60	11.8	59
Grenada	6,260	65	14.2	71
Puerto Rico	4,745	68	61.5	306
St. Kitts and Nevis	2,852	74	19.3	96
Bahamas	2,630	76	31.0	154
Barbados	2,300	80	15.9	79
St. Vincent and the Grenadines	2,259	81	14.7	73
Belize	904	85	9.2	46

Source: Food and Agriculture Organization of the United Nations.

The increasing awareness of the nutritive value of coconut products has boosted demand to the point where demand has sky rocketed over the last five years outstripping supply increasing prices and encouraging increased planting and production.

Slide 27 – World Coconut Oil Production

Table 5 – World Coconut Oil Production

Commodity	Attribute	Country	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017
Oil, Coconut	Total Supply (1000 MT)	World	6,094	6,041	6,213	5,666	5,638	5,486	5,488

Declining production in Indonesia, Philippines, and India – the world's three largest producers – is due to the fact that their trees are now averaging more than fifty years of age and declining in productivity.

Also more coconut growers are harvesting their fruit young for the water instead of allowing them to mature for coconut oil, creating a shortage in the oil market.

Coconut oil prices have soared nearly 20% in a month, largely because of the growing popularity of specialty products such as coconut water.

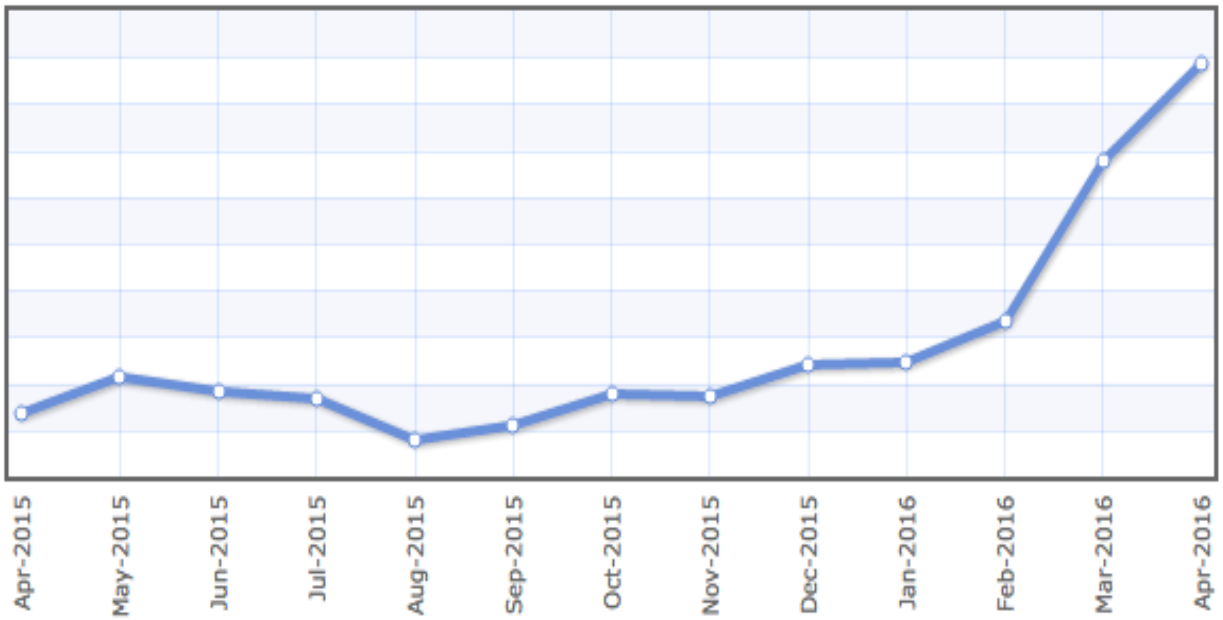
Total world consumption of coconut oil amounted to 3,363 million tons in 2016 and prices have increased by more than 20% to nearly US$1900 per ton since 2016.

A thousand mature coconuts weighing approximately 1,440 kilograms (3,170 lb) yield around 170 kilograms (370 lb) of copra from which around 70 litres (15 imp gal) of coconut oil can be extracted.
This suggests that the oil yield should be about 5% by weight of mature nuts or about 0.15 lbs per mature nut at US$0.90 per lb. The value of a nut based on its oil content would therefore be US$0.15 less the cost of processing.

Obviously the coconut value for fresh water will be more
SBRC assisted me in weighing several coconut shells here and they averaged 3.3 pounds or about 4.5 lbs for the average tender coconut in Barbados.

Slide 28 – World Coconut Oil Price US$ per ton

This shows the recent price increases



Slide 29 - Layout

Spacing 20 feet per tree in row; 20 feet between rows with trees staggered from row to row. This gives maximum density of 100 trees per acre with the diagonal distance being approximately 22 feet between trees.

Slides 30, 31 and 32 – Boron Deficiency

Fertiliser: Triple Super Phosphate 4 pounds per mature tree per year: and Complete fertilizer (12.12.17.2) five pounds per mature tree per year. It is noted that some coconut trees in Barbados are displaying Boron deficiency symptoms which can be treated by foliar spraying with a borax solution containing 5 grams of Borax per litre.

Slide 33 – Coconut Crop Budget Summary Analysis

This shows a gross margin of over Bd$6,000 per annum for a hectare (2.5 acres) of coconuts. Which is very attractive. The major issue is that they take five years to produce after planting.

It is important to note that this financial model is based on sale of the tender coconuts (5 to 7 months) for coconut water. To produce coconut oil the nuts must be allowed to mature. Additionally, economies of scale and hence large scale production is needed.
Barbados currently imports more than 550 tons of coconut oil and other dried coconut products per annum. This would require about 15,000 coconut trees to produce or another 150 acres of densely planted coconuts just to supply the local market. The export market is almost boundless and several hundred acres could easily be required.

I have not done a comparative model for coconut oil but I estimate that the returns for oil would be about a quaryer of that for coconut water. The market volume for oil would be much greater and would have greater export potential.

Let me conclude by pointing out that I see the Scotland District as the main location for future planting of coconuts but that this does not rule out planting in other areas of Barbados

Table 5 - Coconut Crop Budget Summary Analysis

Category	Value (Bd$)
1. Total Variable cost	**12,882.00**
2. Total Fixed Cost	**4,874.80**
3. Total cost	**17,756.80**
4. Gross margin	6,243.20
5. Returns to management*	**6,243.20**
6. Cost of production/lb	**0.37**
7. Return to mangement/lb	**0.63**
8. Gross Return on Investment	**170**

* Plus the value of their own labour which has been costed

Slide 34 – Thank you. Questions?