COCONUT JAMAICA

JAMAICA OBSERVER

Government eyes push for coconut production

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THE Coconut Industry Board (CIB) is pushing to increase coconut production by 100,000 plants or six million nuts annually, even while local private interests express demand for 10 times that amount over the next two years.

Each plant on average can produce 60 to 100 coconuts per year. A coconut is sold for $27.50, according to information from the Ministry of Agriculture. At 60 coconuts per plant, Jamaica could realise an estimated $165 million per 100,000 plants.

It takes four years for a plant to fully develop and start bearing fruit, so the revenue impact may not be actualised until the fifth year of the programme.

Last year Jamaica produced 94.8 million nuts, generating revenues of over $2.6 billion.

Dr Derrick Deslandes, senior director, Centre of Excellency at the Ministry of Agriculture, told the Business Observer that the investment in coconut water comes at an opportune time because the world demand for coconut water, seen as the new replacement fluid, is set to increase.

He said with PepsiCo and Coca-Cola entering into the market for coconut water, there are many opportunities for expansion.

Moreover, one of the island's largest food processors, GraceKennedy has indicated that it has the capacity to absorb output from an additional 10,000 acres under cultivation. An acre can accommodate 60 to 100 trees, which means that the conglomerate has the capacity to additionally take on up to 100 million nuts annually.

"We are growing more coconuts in a time when more people want coconut water," Dr Deslandes said. He noted that the initiative will require the investment of the larger food processors locally.

Coconut water is seen as a natural alternative to sports beverages, energy drinks and flavoured water. The water is high in potassium, packed with electrolytes and is fat free. Natural coconut water is also low in sugar.

The Ministry of Agriculture and the CIB are encouraging local farmers and processors to engage with the industry in increasing the production of coconuts which can open the door to new opportunities in the US $19-billion global market for sports recovery drinks.

So far, one major international player, Vita Coco, realised US$20 million from the sale of coconut water in 2009 according to Forbes.com. Coconut water also represented 60 per cent of the US$10-million revenue of ONE beverages, a Brazilian company. Dr Deslandes said Pepsi and Coke are initially targeting Brazil as a source for the coconut water, but he believes as local production increases Jamaica can capture a portion of the overseas market.

Farmers who have available land for coconut production are being given incentives through the CIB in the form of grants, technical assistance, fertiliser and coconut seedlings to produce more coconuts. The CIB will provide the grants free for four years and assistance in planting the seedlings, once the farmer prepares the land for planting and registers each year with the CIB as a coconut farmer. To qualify, the farmers must have at least 1.5 acres of land to accommodate a minimum of 125 coconut seedlings.

Coconut cultivation can be a good investment as all parts of the plant can be used, which contributes to its value-added potential. Basil Been, director of research at the CIB noted that the coconut plant can be used in many different ways to generate earnings for farmers, including making earrings and beads, cocopeat, mats, and fences. Additionally, the coconut can be used to make busta candy. He said this can generate additional local sales in tourist areas.

"If you package it nicely you can sell it to tourists. Look how many tourists come to Jamaica every day. If we can get one out of every 10 tourists who come on the cruise ships to buy coconut products it will make a difference," Been said.

Additionally, once the coconut tree is fully grown it requires little care from the farmer. It can be used as an intercropping plant, acting as a windbreaker for smaller more susceptible plants such as banana in times of hurricanes. One tree can produce coconut every month for up to 80 years.

"There are a lot of problems, but there are also tremendous opportunities as well. We need a new breed of coconut growers who are doing it because it is profitable, not because you can't find anything else to do," Been said.

Been said the CIB is embarking on a programme to increase the level of awareness about the process of producing coconuts to yield more varieties. An estimated 8,000 coconut farmers produce approximately 3.5 million coconut plants over 15,000 hectares locally.

Farmers are encouraged to grow the Maypan variety of coconut plants as this has been shown to be more resistant to heavy winds and rainfall. The fruits are also larger and produce more water per nut than other varieties, a fact which the ministry said is important to processors of the coconut water.

Agriculture Ministry Upbeat About Coconut Industry

By Douglas McIntosh May 6, 2014 **JAMAICA INFORMATION SERVICE**

Story Highlights

- **Chief Technical Director in the Ministry of Agriculture and Fisheries, Dermon Spence, says the local coconut industry remains a potentially lucrative one.**

- **He says coconut is also used to manufacture alternative sources of energy, "with the husk…being used for fuel in countries such as Indonesia".**
- **Mr. Spence contended that the possibilities and opportunities within the coconut industry are "endless", but can only be realised with increased crop production.**

Chief Technical Director in the Ministry of Agriculture and Fisheries, Dermon Spence, says the local coconut industry remains a potentially lucrative one, capable of generating significant export earnings and employment. This he says is despite the challenges the sector has encountered.

He notes that based on current global market demand for a range of value-added and by-products, including: coconut shell charcoal, coconut milk powder, coconut cosmetics, coconut palm sugar, coconut flour, and coconut chips.

Additionally, he says coconut is also used to manufacture alternative sources of energy, "with the husk…being used for fuel in countries such as Indonesia", while coconut methyl ester (CME) or coco biodiesel, a derivative of coconut oil, is also produced from the crop. This, he informs, is used to fuel motor vehicles and oil-fired power plants, in several countries.

Mr. Spence points out that CME can be used on its own or blended with industrial fuel oil, "making oil-filtered power plants more cost efficient and environmentally friendly, because harmful emissions are substantially eliminated."

He informed that there are also "established and viable markets" for coconut coir fibre and dust, with China, Japan, South Korea, United States, Italy, Mexico, United Kingdom, Canada and Iran, being major importers.

Mr. Spence was speaking at the Coconut Industry Board's (CIB) annual general meeting on Saturday, May 5, at the Jamaica Conference Centre, downtown Kingston, where he represented Portfolio Minister, Hon. Roger Clarke.

In his remarks, Mr. Spence contended that the possibilities and opportunities within the coconut industry are "endless", but can only be realised with increased crop production.

He noted that local coconut production totaled 97.4 million nuts in 2013, describing this as "way below market demand", and underscoring the need for improvement.

The Chief Technical Director cited several factors, such as Lethal Yellowing, which he argued "continue to pose a problem for the survival and sustainability of the industry."

"It is well documented that the industry, for some time, has been one that is ailing. This…is as a result if setbacks occasioned by the impact of the disease on the industry, and the problem of praedial larceny," he stated.

In light of this, Mr. Spence commended the CIB for implementing initiatives to assist in fighting the disease. These, he outlined, include analyzing different varieties of the coconut palm for resistance to disease; conducting surveillance and eradication measures; continuing research to develop highly resistant planting material; and exploring "effective means" of controlling and managing Lethal Yellowing.

He stated that, "these initiatives must be lauded because, with limited resources, you have accomplished so much on your own, and with the help of international donor agencies".

Mr. Spence said that while there is need for a more reliable and faster method of replacing trees, the Board's efforts to increase the production of coconut through its planting programmes, must be commended.

Through this programme, some100,000 seedlings are provided to registered farmers annually," he said, adding that "farmers also receive fertilizer for 80 per cent of (the) seedlings granted, a weed grant, and technical assistance."

Mr. Spence noted that despite the challenges, the CIB continues to promote the industry by purchasing coconuts from farmers for its Coconut Shop. He advised that approximately 915,000 coconuts were purchased at a cost of $36 million, for use in baked products and confectionaries.

He also emphasised the opportunities to be gained from cultivating coconut orchards and engaging in value-added activities. He argued that establishing factories to produce oil and milk powder, among other products, will not only provide many job opportunities, but will require "great amounts" of coconut.

"I, therefore, urge you to put plans in place to establish such facilities. I (also) encourage you to produce more coconuts. With increased production, we could realize, not just increased job opportunities, but also greater foreign exchange earnings, and improved lifestyles. Opportunities do abound in the global marketplace for coconuts and coconut products. We need to grasp those opportunities," Mr. Spence stated.

He added that the Government is committed to ensuring that advancements are made "as we pursue the development of a modern, efficient, and internationally competitive sector that contributes to the development and well-being of our people."

The Gleaner
Jamaica WI
Established 1834

JPG to produce coconut water

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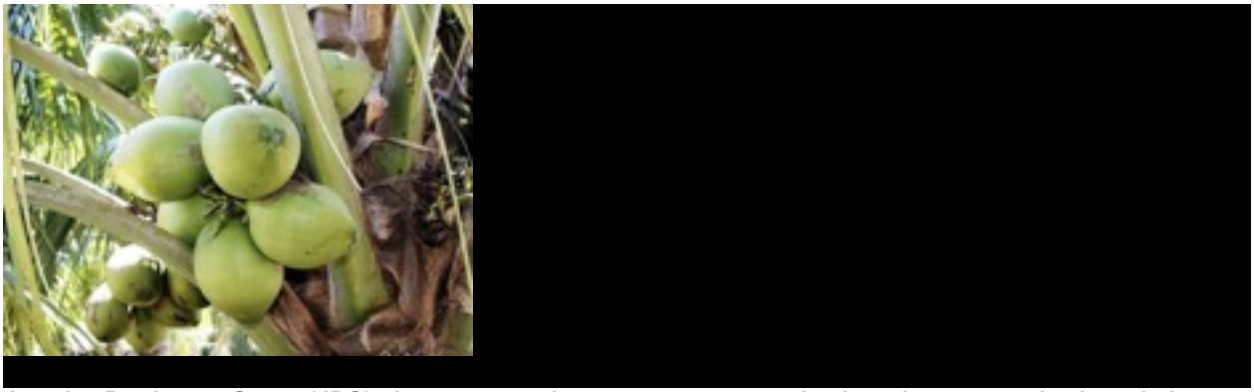

Jamaica Producers Group (JPG) plans to enter the coconut-water market in order to monetise its existing 100 acres of coconuts.

The conglomerate already has retail channels set up for its snack operations, which could be leveraged for the distribution of the beverage, but it may need supplies equivalent to about 400 acres of coconuts to make the venture viable.

"I am a passionate believer in coconut water," said Chairman Charles Johnston, responding to a query at Jamaica Producers' annual general meeting last Thursday in Kingston.

"Actually, we have over 100 acres of coconut planted, and I think we need another 300 acres to get up to factory size. In the meantime, I would like to push management to start without that by contracting other farms to supply us. But, we have a good quality team and I think we can make the best quality coconut water in the world," Johnston said.

Producer's businesses largely span Jamaica and Europe. Last year, the group earned more than half of its total J $6.79 billion in revenues from sales in The Netherlands, which falls under its juice-focused JP Europe division. Jamaica earned roughly one-quarter of revenues at J$1.6 billion.

Coconut water is highly perishable, but Johnston said JP has technology available to lengthen the life of the product.

"We have the technology in Europe to extend the shelf life of juice and, therefore, we have all the components to make excellent coconut water," he said.

JPG's rival in the food sector, GraceKennedy Limited, already retails a canned, pulp-based coconut-water product under the Grace brand that is produced for the company in Thailand.

GraceKennedy has the only unchilled and canned product on the market. Otherwise, the market is populated by chilled products that are bottled domestically by a growing number of small and micro-business operators.

Quality of the nut

Coconut water is naturally sweet, but taste varies according to the quality of the nut. The product is bottled without additives and is consumed as a healthy, refreshing drink.

The market has expanded dramatically in recent years, but its scope is largely untracked. Its size in volume sales or turnover remains unknown.

Jamaica produced an estimated 96.4 million coconuts in 2012, slightly higher than the previous year, according to data from the **Economic and Social Survey Jamaica** (**ESSJ**) published by the Planning Institute of Jamaica. Coconut production has been hobbled by the lethal yellowing disease, which destroys trees, according to the **ESSJ**.

StabroekNews.com

Jamaica company producing cold press virgin coconut oil

FEBRUARY 18, 2012 · BY **STABROEK EDITOR** ·

(Jamaica Gleaner) MORANT BAY, ST Thomas: Operations at the 685-acre pure stand coconut property at Nutts River in Morant Bay, St Thomas, which has diversified its operations from copra production to cold press virgin coconut oil and the bottling of coconut water, is worth going miles to see.

The father-son team of Michael and Stephen Black has positioned Michael Black Farms Ltd to capitalise on the renewed demand for coconut oil and the growing thirst for the water, 70 per cent of which is exported.

Even at peak production, they are unable to meet the demand for both products, but it hasn't always been that way. Michael recalls the devastation wrought by Hurricane Gilbert on September 12, 1988.

"We used to reap on average about 100,000 nuts per week, and Gilbert came along and swiped 44,000 **trees** and those that were left were badly damaged. It came on a Monday and when we came up here the Tuesday, we decided we were still going to stay in **coconuts**."

To most people, this did not make sense, especially given the critical shortage of planting material and the average payback time of seven years before trees would be expected to start bearing. Then there would be the ever-present threat of praedial larceny, and so intercropping with bananas was necessary to provide some income. So for all intents and purposes, the decision to plant pure stand coconut did not make economic sense, but Michael Black would not be deterred. After all, they had operated four copra houses before the hurricane.

With the help of the Coconut Industry Board, he was able to gather some 25,000 seeds to start a nursery. Thereafter, his team set out on an extensive replanting programme, putting in 60,000 trees, pushing down the damaged ones, and planting in areas that had not been cultivated before. In order to focus solely on coconuts, Michael took the decision then to get out of beef cattle rearing.

He remembers those trying days: "It took us some time to go fully back into production, and shortly afterwards, coconut water was starting

to take off and we used to sell coconuts to the higglers and the people who bottle. So we started our coconut water bottling business some 15 years now, and by being able to take off all our coconuts, we were able to export green dwarfs abroad. We would sell the nuts to nurseries in Miami and other places abroad where they would propagate them and grow out the seedlings."

ramped up production

Anticipating a growing demand for the Blacks ramped up production, only to find themselves unable to offload their bonanza of nuts. The Americans. especially, would buy during the summer months, but come winter, there were no sales. So for at least half of the year, they were not doing much business, except for supplying their own needs. They were selling to other countries such as The Bahamas and The Cayman Islands, but not enough to compensate for the fallout in sales from the United States.

"I couldn't absorb the amount I had, and it came to us that if we went into the oil business, we could use the product right around the year," Michael explained.

This decision was informed by Stephen's visit to The Philippines, where, in addition to witnessing the cold-press method of extracting oil, he was exposed to the use of coconut by-products on a level he had never imagined.

"I then came back here and set up a factory to remove and use the dried coconut in the oil business where we started this cold-press thing, and from that, the rest is history," he told **The Gleaner**.

The coconut is grated using electric graters and placed on heated tin sheets (fire underneath) where it is rotated until most of the moisture is removed. The coconut flakes are placed in containers to cool overnight before being put into the press, which extracts pure, or virgin, oil. This is left to settle for some time and then strained and bottled on site. It is marketed under the Miss Dawn label, a tribute to Michael's first wife and Stephen's mother.

Michael admits that there is a serious price difference between the cold-press oil and the one produced by the traditional method of boiling the coconut 'milk'. And with good reason, given that it takes on average between 125 and 130 nuts to generate a gallon of oil using the newer method.

With the seven-tables factory processing in excess of 500 coconuts each and running from Monday to Friday, there are plans to expand the operation as the factory is still struggling to meet demand.

http://www.bioversityinternational.org/fileadmin/bioversity/publications/Web_version/362/ch6.htm

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Coconut breeding programme in Jamaica

Millicent M. Wallace
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Introduction

The coconut is not indigenous to Jamaica. The first cultivar, the Jamaica Tall, was introduced in the 15th century.

Lethal yellowing disease (LYD) was first reported in the island in 1884 (Been 1992a), with periodic outbreaks since. The Jamaica Tall cultivar was found to be highly susceptible to this disease, which is thought to be caused by a Mycoplasma-like organism (MLO) with *Myndus crudus* being a probable vector. The search for LYD-resistant cultivars became important to the survival of the coconut industry in Jamaica. The plant breeding programme of the Coconut Industry Board began in 1961 with this search as a priority. Of the local cultivars screened, the Malayan Dwarf (a cultivar introduced in the late 1930s) was found to have high LYD resistance.

Several cultivars were introduced from the major coconut-growing regions, but none was found to have greater LYD resistance than the Malayan Dwarf. F_1 hybrids were made using combinations of the Malayan Dwarf and selected tall cultivars from the introductions, the Jamaica Tall and Panama Tall. The progenies were incorporated into hybrid trials.

From these trials, the Maypan (Malayan Dwarf × Panama Tall) was selected and released for commercial planting in 1974 (Charles 1961). It has since superseded the parent dwarf as the most widely planted coconut cultivar in Jamaica. Maypan seednuts are also exported to the USA.

In the late 1970s, F_1 hybrids, from Malayan Dwarf as mother palm and selected tall introductions and Fiji Dwarf as pollen parents, were incorporated into hybrid trials with the Malayan Dwarf and the Maypan. These trials were laid out in 1980 (HE1/80 Hybrid Trials).

From data gathered, the hybrids with genes inherited from the Thailand Tall, Cambodia Tall, Karkar Is. Tall and Bougainville Tall were selected for semi-commercial (and later commercial) development. Data collection on these hybrids continue, at both experimental and semi-commercial stages.

More recent research involves the development of F_1 hybrids using selected dwarf introductions as mother palms, and the Panama Tall as male parent. The resulting hybrids will be compared with the Maypan. Work is also being done on second generation (F_2) Maypans.

Present coconut production and hectarage

There were 149.82 million nuts produced in 1997, which is equivalent to 21 101 t of copra. Coconut production fell sharply after hurricane "Gilbert" in September 1988. Since then, there

has been a gradual recovery, but pre-"Gilbert" levels have not yet been attained as shown in Table 1.

Present farm-level productivity

The current production level is 80-100 nuts per palm per year (with optimum inputs amounting to US$ 330/ha) generating 9000 nuts/year/ha. Net income derived is estimated at US$ 960/ha. However, on well-managed farms, about 15 000 nuts/ha/year are produced, with net income twice that of the average farm (US$ 2035/ha/year).

Coconut production in Jamaica is hampered by a number of constraints; the major one being prohibitive fertilizer costs (and problems involving availability and transport). This results in less than adequate input levels (coconut received about 40-60% of overall fertilizer requirements) and therefore, decreased yield. Praedial larceny, and lethal disease like LYD and bud rot also limit the production of coconut in the country. Small-scale farmers are the most seriously affected and some therefore, opted for the low input - low return situation.

National coconut germplasm

Present status. There are presently 62 accessions and 2544 palms in the country's germplasm collection. They are conserved in field genebanks.

Utilization. Cultivars are periodically screened for their suitability as mother palms, pollen parents, or for development as 'straight varieties'. Parents of F_1 hybrids for screening and development are selected from the germplasm collection.

Genetic erosion in the country. The coconut is not indigenous to Jamaica and there are, therefore, no types in danger of destruction. The germplasm collection consists entirely of introduced cultivars. The only threat of erosion is LYD which has caused the extinction of some susceptible cultivars.

Future priorities for collection, conservation and utilization. Cultivars which are highly resistant to LYD (but not yet a part of the local germplasm collection) would be considered for collecting and field testing.

Type of coconut grown in Jamaica

In Jamaica, the Dwarf × Tall hybrid is the most popular commercially grown coconut, followed by the dwarf type. The Malayan Dwarf superseded the Jamaica Tall in the sixties due to its greater LYD resistance, precocity and higher yields.

The Maypan (Dwarf × Tall hybrid) was released for commercial planting on a phased basis and has since caught up with the dwarf, although its resistance is slightly less. This cultivar is preferred by farmers mainly because of its larger nut size and greater windstorm tolerance. (It also shows more acceptable production under marginal/low-input conditions.) Other Dwarf × Tall hybrids are now growing under commercial I conditions, after several years of semi-commercial cultivation (i.e. in small blocks on holdings of selected farmers with observations done). Tall types are no longer grown on commercial scale.

Both the dwarfs and F_1 hybrids require significant fertilizer and weed control inputs for optimum performance. In addition, both are susceptible to bud rot and premature nut fall under moist conditions, with the dwarf more susceptible than the hybrid. Under marginal conditions, the dwarf has very small nuts.

National replanting programme

The first replanting programme was carried out in the 1960s after a LYD outbreak. Five and a half million Jamaica Tall palms were to be replaced on a phased basis by Malayan Dwarfs, and farmers were given assistance to do so. This project was undertaken by the Ministry of Agriculture and the Coconut Industry Board (Harries and Romney 1974).

In September 1988, hurricane Gilbert destroyed over 2.6 million palms, representing about 45% of the island's coconut population. In response, the Coconut Industry Board implemented the Hurricane Rehabilitation Programme in early 1989. Farmers were provided with seedlings (at a subsidized cost) and a portion of the fertilizer (66.7%) needed for the first three years. This scheme ceased at the end of 1992 (CIB 1992).

There is no organized replanting programme in force at present. Farmers are still offered Malayan Dwarf and Maypan seedlings at subsidized rates. There are indications of a 'levelling-off' of seedling demand, although coconut production has not yet attained pre-hurricane levels.

The target includes a phased planting of other cultivars in order to achieve genetic diversity. Those that were previously at the semi-commercial stage have since been released for commercial planting on a phased basis. Farmers have been encouraged to plant blocks of the cultivars when available.

Breeding strategies

Objectives:

a) to develop cultivars with high stable yields (preferably precocious) with adequate resistance/ tolerance to important pests and diseases;

b) to develop cultivars which show incremental yield response to high-level agronomic and cultural practices, as well as adequate yield under low input/marginal conditions; and

c) to broaden the genetic base of the national coconut industry so that ultimately, farmers will have a matrix of cultivars (usually about five) on their holdings.

Strategies:

a) to continue field testing F1 hybrids having the Malayan Dwarf as mother palm and selected introduced tall varieties as pollen sources (cf. HE1/80 Hybrid Trials);

b) to continue development of cultivars using alternative mother palm prospects;

c) to screen promising cultivars for further development/hybridization; and

d) to apply purification measures to existing local Malayan Dwarf population (and ultimately the Maypan) with a view to maximizing the LYD resistance of the commercial coconut population.

Cultivars to be used in b) and c) will be selected from local germplasm collection.

Coconut breeding action plan and expected output in the next ten years

a) Further testing of 'sister hybrids' to the Maypan, such as: MD × Thailand Tall

MD × Cambodia Tall
MD × Karkar Tall
MD × Bougainville Tall
(selected based on the performance in the HE1/80 Hybrid Trials)
Commercial production of these cultivars has begun.

b) Broadening the genetic base by using dwarfs other than the Malayan as mother palms with the same selected pollen parents as in above. Dwarfs under consideration are the Chowghat Green (ex India), Sri Lanka Green, and Sri Lanka Yellow.

i) Multilocation hybrid trials will be laid out using one pollen parent at a time, beginning with the Panama Tall, followed by the other selected tails, then other pollen parents of special interest, including the Jamaica Tall. In each trial the Maypan (or respective Malayan Dwarf hybrid) will be incorporated for comparison. Simultaneous multi-location informal testing of open-pollinated progenies of these dwarfs will be done at farmers' holdings. 'Bulking' of prospective mother palm populations will continue.

ii) The Sri Lanka Yellow Dwarf will be considered for development as 'straight variety' (to be tested against the Malayan Dwarf).

c) Developing suitable fertilizer formulations specific to each released cultivar.

d) Screening other promising cultivars from local germplasm collection for development of F_1 hybrids or 'straight varieties'.

e) Reproduction of cultivars in germplasm collection as a means of conservation.

f) Continuation of testing the F_2 Maypans.

g) Surveying the local Malayan Dwarf population, and selecting palms showing high phenotypic purity. Multiplication of pure palms, and further selection from their progenies will be done with a view to improving the purity of this cultivar (and subsequent hybrids).

Work on a), b), and e) are in progress and g) has just begun.

National institutions involved in coconut breeding

At present, the Coconut Industry Board is the only national institution involved in coconut breeding. It is financially supported by the British Government, FAO, USAID, and the Ministry of Agriculture (Jamaica).

Conclusion and recommendation

Jamaica has had a vibrant coconut breeding programme over the years. Our germplasm collection currently has 62 accessions (Been 1993, per comm), being ranked as one of the main collections in the world (Persley 1992). The threat of LYD and hurricanes have been motivating factors to its existence and size.

The maintenance of a stable local coconut industry has been a major achievement. Breeding techniques have been refined. The Maypan, an F_1 hybrid developed locally, is currently exported to the USA and expansion to other markets in the foreseeable future is likely.

There is still much room for further research, especially in the realm of molecular genetics. This would enhance defining the inheritance of disease resistance and the nature of Mycoplasma-like organisms (MLOs), as well as accelerate screening for disease resistance. To achieve this, training at different levels would be necessary, as well as financial and technical assistance (Been 1992b). A regional approach to this research would be an advantage.

References

Been, B.O. 1992a. Lethal Yellowing - the Jamaican experience. *In* Lethal Yellowing: Research and Practical Aspects. Kluwer Academic Publishers, Dordrecht.

Been, B.O. 1992b. Status of existing coconut collection in Jamaica. Report of a Working Session for the Implementation of the International Coconut Database. CIRAD/IBPGR.

Charles, A. E. 1961. Selection and breeding of the coconut palm. Tropical Agriculture. 38(4).

Coconut Industry Board. 1992. The coconut grower. CIB. Jamaica W.I. 23(3).

Harries, H. C. and D. H. Romney. 1974. MayPan: An F1 hybrid for commercial production in Jamaica. World Crops, May/June.

Persley, G. J. 1992. Replanting the tree of life. CAB International, ACIAR, TAC/CGIAR, UK.

Table 1. Area and production of coconut (1987-93)

Source: Coconut Industry Board Economic Reports

Year	Area (ha)	Nut production	
		No. in million nuts	Copra equivalent (t)
1987	25 921	156.4	23 349

1988	16 754	167.7	25 033
1989	17212	70.8	11 700
1990	18202	74.5	10322
1991	19 080	99.9	13 856
1992	19 782	118.4	14919
1993	20 250	127.1	17 907
1994	20 539	133.3	18 769
1995	20 830	139.1	18 135
1996	21 118	143.4	20 200
1997	21 579	149.8	21 101

Coconut breeding programme in Mexico

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Introduction

Coconut palms in Mexico are cultivated in two well-defined regions along the coastal areas of the Caribbean Sea, the Gulf of Mexico and the Pacific Ocean. The overall estimates for 1990 comprised a planted area of 183 483 ha, which today accounts for an annual gross production record of 190 660 t. During the last decade (1981-90), there was a steady trend toward the production of copra, which made up more than 80% of the total coconut harvested. The remaining 20% was locally marketed for fresh fruit consumption (PROSA 1992).

The domestic coconut oil and fat industry has been mostly oriented toward manufacturing non-edible products, including soap, cosmetics and pharmaceuticals. These products utilized a large proportion of the copra obtained by the traditional sun-drying process. Coconut oil is used as follows: 54% for the manufacture of soap and detergents; 25.2% for dried milk reconstitution; 2% for maternal milk reconstitution; 16.3% for food purposes (coating and confectionery); and, 2.4% for cosmetics. Coconut cake is used for feed production (INEGI 1988).

Copra producers cultivate and harvest plots of small sizes (4-6 ha), usually associated with other fruit trees (PROSA 1992). They have depended on the imposed prices and market demands set by local traders and private entrepreneurs, who have been stimulated by governmental programmes, including levies for large scale importation of coconut oil to meet the internal demand.

Little processing is done at the farm level because local traders buy copra from smallholders and sell it to the factories. This intermediary process has promoted an increase in the domestic prices of copra. Entrepreneurs have reacted by increasing their purchases of copra and coconut oil from outside the country. Oil extraction, purification and subsequent processing is typically accomplished by factories located in large urban centres.

This scheme has imposed little pressure on the farmers to replant old groves, increase coconut yields, maintain and cultivate the planted areas, attain higher quality standards and gain motivation to highlight the opportunities that come from product diversification.

Other factors that can explain the complex situation confronted today by the coconut industry are the socioeconomic considerations. Most farmers are confronted by a situation where coconut production has lost the prime position (low productivity, price instability, intense competition with other crops, lack of financial support, etc.), among oilseed crops.

At present, the situation of coconut growers and of the coconut industry is weakening due to the additional presence of the Lethal Yellowing disease (LYD). The rapid spread of the disease from the Yucatan Peninsula toward the copra producing areas in the states of Campeche, Tabasco, Oaxaca, Guerrero and Colima, is posing a threat to Mexican coconut population and thus, encouraged studies at conserving and utilizing the local coconut germplasm.

Present coconut production and hectarage

Based on the extension of planted areas, coconut palm ranks second among perennial fruit trees cultivated in Mexico, after coffee (Rodriguez and Becerril 1993).

Oilseeds like sesame, safflower, sunflower, soybean, cotton, maize and groundnut, strongly compete with copra in terms of harvested areas and economic returns. Hence, local consumption of coconut oil has registered a noticeable decrease. In 1960, 99.7% of the total vegetable oil produced in Mexico was locally consumed and copra filled 34.3% of the demand. In 1975, 94.2% was locally consumed and copra represented 18.5% of the demand. By 1990, 38.1% of the total production was locally consumed, the remaining was imported and copra represented 33.9% of the demand.

INEGI (1988) reported that soybean entered into scene by 1960, when it represented 0.4% of the oil seeds growing areas. Fifteen years later, the harvested area increased up to 79.5%. The sudden growth in soybean production had a detrimental effect over other oilseed crops, including coconut.

However, during the last decade (1981-90), there was a rough increase in the coconut harvested areas (Table 1), from 148 047 ha in 1981 to 183 313 ha in 1990, an annual average growth rate of 2.09% (PROSA 1992).

Present farm level productivity

Although coconut harvest areas registered a noticeable growth during the last decade, an inverse trend in productivity was identified. Lower yields have resulted from the combined effects of different factors, among them: (1) poor yielding plantations; (2) growing incidence of pests and diseases; (3) extensive use of low-producing or inferior varieties; (4) substitution by more profitable crops; and (5) little attention paid by farmers to technical recommendations (SARH 1992).

National yield average

During 1981-91, copra yield in Mexico per hectare oscillated between 0.989 t/ha (1984) and 1.29 t/ha (1982). The average yield was 1.2 t/ha (SARH 1992). Differences in productivity between the Pacific Coast and the Atlantic Coast regions are notable due to cultivation practices. In the Colima state, 95% of the coconut farms are irrigated and received regular fertilization, weeding and phytosanitary practices. Thus, by 1991, it recorded an average yield of 1.72 t/ha. This opposite situation is seen on the Gulf Coast region, in the state of Veracruz and

Yucatan, where coconut farms are not irrigated and are not regularly attended hence, unproductive (SARH 1992).

Estimated net income

Economic returns depend on the average yield per hectare and also on the price of copra. The trend toward lower yields and lower prices of copra have lead to income losses. Growers tend to adjust to this situation by reducing investments on cultural practices below the standard and substituting coconut for more profitable activities (PROSA 1992). Shown below is the estimated income from a hectare of a typical coconut farm:

Average production cost/ ha	= US$ 450
Guaranteed prices	= US$ 230-US$ 395
Yield/ha	= 1.2 t/ha
Income:	
situation 1	= US$ 270-US$ 450 = (-US$ 180)
situation 2	= US$ 474-US$ 450 = US$ 24

Well-managed farms are not clearly defined under the present circumstances. However, they have been used as a model to project future demands.

National coconut germplasm

Early efforts to establish a germplasm collection were directed by a decentralized institution (Impulsora Guerrense del Cocotero). With the technical assistance from IRHO, Impulsora Guerrense started a programme introducing coconut seeds from the Côte d'Ivoire in 1977 to strengthen the coconut breeding programme. This initiative faced various problems and the collection remained unattended, resulting in the eventual loss of some accessions. Since 1989, this collection was enacted to the Instituto Nacional de Investigaciones Agricolas, Forestales y Pecurias (INIFAP) of the Ministry of Agriculture. INIFAP has undertaken research on coconut germplasm in Mexico since 1974 emphasizing the aspects related to genetic improvement. Selection of high yielding palms, production of hybrid materials, and field trials and assessment of inherited productive characters have received much attention. Keeping records and designing methods to document the performance of tested materials have not received the deserved importance, which was a contrasting feature of a national germplasm collection.

By 1989, the Centro de Investigacion Cientifica de Yucatan (CICY) successfully started a programme to establish a coconut germplasm collection in the Yucatan Peninsula. The aim of the collection is to conduct research on coconut germplasm and to evaluate the resistance level of different genotypes to LYD. In the long term, the collection will be a source for selecting resistant materials.

Size of collection

The coconut germplasm collections held by CICY consist of 37 accessions of exotic cultivars, local strains, and a few hybrids. Seeds were collected during 1989-93 in different coconut producing areas along the Pacific Ocean and the Gulf of Mexico coastal areas.

Pacific tall types are best represented in the collection (20 accessions), whereas Atlantic tall types, (2 accessions); exotic tails (3 accessions); dwarfs (8 accessions) and hybrids (4 accessions) are at present poorly represented. Pacific tall types show higher diversity due to their different origin. Atlantic tall types are quite homogeneous and show less variability.

Dwarf population derived from recent introductions to Mexico may not be "true to type", but hybrids from unknown origin. The four acquired hybrids came from a seedgarden located in Tabasco and are produced on a small scale.

Types of conservation

Field genebank

After germination, seedlings are transplanted to plastic bags and are placed in rows in the nursery. Meanwhile, field work is in progress to establish resistance trials to test the available germplasm against LYD in two different sites of the northern coastal Yucatan state. The planting design involved replicated plots of nine coconut palms from each of the accessions in a randomized block design. Blocks are separated by rows containing 'Atlantic tails'.

The development of the young plants is monitored at periodic intervals, according to the following descriptors (IBPGR 1992): height, vertical growth, number of leaves emitted, stem girth, girth growth, and petiole colour. Mortality rate is similarly monitored. This information is used to distinguish among genotypes and to conduct preliminary evaluations, documenting the reactions to specific agroecological conditions. Computerized records are kept on individual accessions.

In vitro

Techniques for *in vitro* culture have been adopted to assist the collecting of mature embryos and facilitate the exchange of coconut germplasm. The use of this method could also be adopted to store the genetic variability to some extent. A joint project where CICY participates with other four institutions (ORSTOM, WYE, PCA & CIRAD), receives economic support from the Commission on the European Communities which involves a long term research programme.

Utilization

Selection of Malayan dwarf mother palms for the purpose of establishing seedgardens, and identification of domestic Pacific tall ecotypes which can be used to develop F_1 hybrids with improved tolerance to the LY disease are the two main goals of the current breeding programme (Carrillo 1993). However, there was a gap of knowledge identified concerning coconut breeding methods which could be applied to parental selection, regional testing and mass propagation in isolated seedgardens (Santos and Sangare 1992).

Genetic erosion

The Yucatan Peninsula and the Gulf Coast coconut populations are mostly at risk due to the spread of LYD. The Pacific Coast populations are not under threat at present but some pressure has been exerted by changing land use patterns, i.e. development of touristic facilities and substitution by more profitable crops.

The LYD affected area in the Yucatan Peninsula, comprising more than 7 000 ha is, at present, severely damaged. Coconut groves in this area have been intensively explored in order to assess the extent of the disease and to evaluate the losses due to LYD. The Atlantic tall variety is mostly endangered due to its low resistance to LYD.

Pacific tall varieties are suffering losses due to substitution by other crops and also by urban/ touristic development. A survey is needed to examine the consequences of destroying old plantations that might contribute specific adaptive traits useful to breeders (Foale 1992).

Future priorities for collecting, conservation and utilization

The search for varieties and hybrids showing resistance to LYD, high yield and adaptation to specific environment, has a high priority in terms of germplasm utilization.

The coconut diversity present in the Pacific coastal area needs to be completely surveyed. This work should be accomplished in the short term. Germplasm introduction to assist replanting programmes and also for breeding purposes has also been emphasized.

In vitro conservation methods could be adopted to store genetic resources at risk.

Types of coconut grown

A recent survey of the coconut diversity found in Mexico (Zizumbo *et al.* 1993) showed that two contrasting tall types, defined by Harries (1978) as the domesticated ('niu vai') and the wild ('niu kafa'), can be identified under different geographical ranges. Coconut populations showing intermediate characters, due to crossing and introgression, are more abundant along the Pacific coast. The fruit component analysis (FCA) method was used to identify and document each collection (Whitehead 1968; Harries 1978). Geographical origin, phenotypical characters and seed rate germination are also under study (Arellano 1993; Arellano and Zizumbo 1994).

Ethnobotanical and ecogeographical exploration have shown that these materials were of exotic origin. This was evidently supported by the fact that coconut palms were introduced to different areas of Mexico during the second half of the 16th century (Zizumbo *et al.* 1993). It can be presumed that some coconut groves were established near the (founding areas, but it is uncertain that they represent the original strains. Fruit component analysis undertaken on these populations showed a high degree of introgression, which can result from a long hybridization cycle, or an indication of a different source from which the original seeds came from.

Dwarf populations arose from recent introduction to Mexico, but are not well documented. Dwarf coconuts are equivalent to the Malayan Dwarf type even when some of them can not be 'true to type', but hybrids of unknown origin.

F_1 hybrids developed by INIFAP came from a seedgarden located in Tabasco and are produced in a limited number. These hybrids represent crosses between a progeny of the Malayan Dwarf coconut (yellow and red types), from Tabasco and Pacific Tall local populations (from Michoacan).

Comparative performance of coconut hybrids and cultivars

Comparative studies are underway since field trials were established recently. Research is focused on resistance to LYD, but studies on specific combining ability and sources of resistance to coconut population are also in progress.

The Malayan Dwarf in Yucatan is highly resistance to LYD, as it was in Jamaica and Florida. Domestic populations from the Pacific coast could be an important source of resistance to LYD (Harries 1990); The Atlantic tall variety is highly susceptible to LYD, but in turn is very tolerant to low input application and poor agronomic practices, and has high copra content much appreciated by farmers.

National replanting programme: present status and future targets

Replanting old groves and rehabilitation programme of devastated areas have been undertaken. However, present production of selected varieties and hybrids cannot meet the demand for planting materials. A particular programme on LYD has encouraged the organization of seedgardens and nurseries and is creating opportunities for selecting resistant varieties. The LYD affected area is over 15 000 ha in the Yucatan Peninsula. Another 27 000 ha in the state of Tabasco are under threat. The current programme aims to attend to these productivity constraints: cadang-cadang, lethal diseases, insect pests, etc.

National commitment to proposed project

CICY is actively encouraging collaboration with international research groups in the following areas of national interest:

- Germplasm collecting, evaluation and utilization
- Nursery management and field planting methods
- Disease indexing, screening and control methods
- Tissue culture research
- Organization of training courses

Other institutions in Mexico have lended support to current coconut initiatives. Nevertheless, a stronger collaboration on a regional scale shall be sought (IICA, OIRSA, etc.)

National institutions involved in coconut breeding and identified projects

Federal government institutions are actively participating, through the Ministry of Agriculture, in the coconut breeding programme. The National Institute of Agriculture, Forestry and Ranching is presently conducting research on coconut breeding. It is concerned with selecting high yielding palms through mass selection methods. Since 1981, research is also focused on the development and screening of LYD resistant hybrids, based on the assumption that the Pacific tall genotypes are similar to those used in Jamaica as male parents for the production of the Maypan hybrid (Carrillo 1993).

In those states of the country where coconut makes a substantial contribution to farming activities, there are special institutions giving support to the coconut breeding programme. Some state government programme (Quintana Roo, Yucatan, Campeche, Tabasco, Guerrero and Colima) have contributed to increase the capacity of areas devoted for seedgardens, nurseries or field trials.

Coconut growers are also interested in playing an active role in coconut breeding by giving support to those activities which are considered to be of utmost importance. The National Coconut Growers Organization is at present promoting initiatives oriented toward upgrading the breeding programme.

CICY is an active centre conducting research on coconut germplasm as well as on LYD. It has been considered a focal point because of its potential contributions to the region.

Funding agencies for coconut breeding projects in Mexico

Public funds are provided through federal and state institutions, to practically cover the monetary requirements of the breeding projects. CICY programmes have obtained funds from national (CONACYT, SARH, State government, private funds) and from international sources (CEE, OIRSA, IICA). Cooperative projects should enhance capabilities to approach other funding sources.

Conclusion and recommendation

Coconut cultivation has been an important activity in Mexico and, under present conditions of economic opportunities, its role can be greatly improved.

Although coconut breeding in Mexico, as in other country programmes, has been conducted on an irregular basis, it will be crucial to face the problems derived from cultivating low yielding, old and disease-susceptible palms. In order to meet the challenge, it is essential to make use of the available improved technology.

The extent of the cultivated areas, the diversity of the domestic germplasm and varying agroecological conditions make it imperative to undertake a long term programme on coconut breeding in Mexico on a cooperative basis with other countries.

References

Arellano, J. 1993. Colecciones de germplasma de cocotero. Paper presented at the International Symposium on Lethal Yellowing. Centro de Investigacion Cientifica de Yucatan. Yucatan, Mexico.

Arellano J. and D. Zizumbo. 1994. Germination of coconut genotypes collected in Mexico. In Press.

Carrillo, H. 1993. Manejo integral del cocotero en Mexico. Paper presented at the International Symposium on Lethal Yellowing. Centro de Investigacion Cientifica de Yucatan. Yucatan, Mexico.

Foale, M.A. 1992. Coconut genetic diversity: present knowledge and future needs. Pp. 46-53 *in* Coconut Genetic Resources. Papers of an IBPGR workshop, 8-11 October 1991, Cipanas, Indonesia. International Network Series No. 8, IBPGR, Rome.

Harries, H.C. 1978. The evolution dissemination and classification of *Cocos nucifera* L. Bot. Rev. 44:265-320.

Harries, H.C. 1990. Malesian origin for a domestic Cocos nucifera. Pp. 351-357 *in* The Plant Diversity of Malesia. Kluwer Academic Publishers, Dordrecht.

IBPGR. 1992. Descriptors for coconut. International Board for Plant Genetic Resources, Rome, Italy. 61 p.

INEGI. 1988. Resultados economicos. Instituto Nacional de Estadistica, Geografia e Informatica. Mexico.

PROSA, 1992. Estudio de la produccion de copra en Mexico. Report prepared by PROSA Consultants. Mexico.

Rodriguez and Becerril, 1993. La investigacion y la docencia en fruticultura en Mexico. Ciencia (1993) especial, 99-110.

Santos, G.A. and A. Sangare. 1992. Evaluation and utilization of coconut genetic resources. Pp. 70-77 *in* Coconut Genetic Resources. Papers of an IBPGR workshop, 8-11 October 1991, Cipanas, Indonesia. International Network Series No. 8, IBPGR, Rome.

SARH. 1992. Programa Nacional "C'ampana contra el amarillamiento letal del cocotero". Manuscript.

Whitehead, R.A. 1968. Collection of coconut germplasm from the Indian/Malaysian Region, Peru and the Seychelles Islands and testing for resistance to lethal yellowing disease. CPL 17, FAO, Rome.

Zizumbo, V. D., R. F. Hernandez and H. C. Harries. 1993. Coconut varieties in Mexico. Econ. Bot. 47(1):65-78.

Table 1. Coconut production and productivity in Mexico, 1981-90

Year	Cultivated area (ha)	Harvested area (ha)	Copra (t)	Yield (kg/ ha)
1981	182 064	148 047	190 966	1.29
1982	200 513	170 137	218 239	1.27
1983	193 361	172 140	190 135	1.10
1984	193 035	174 976	173 075	0.98
1985	192 905	172 604	180 185	1.04
1986	189 570	175 959	195 700	1.11
1987	192 901	179 947	191 170	1.06
1988	194 256	185 644	186 550	1.00
1989	192 942	182 283	203 049	1.11
1990	183 483	183313	190 660	1.04
AAR (%)	0.09	2.09	-0.02	-2.36