



# ***Cocos nucifera***

**A coconut monograph by Mariana Zornosa Hernandez**

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## **Introduction**

The following is an agricultural science monograph about the coconut, *cocos nucifera*. *Cocos nucifera*. For thousands of years the coconut from the coconut palm has been a prominent source of versatility, and its sustainable practices are seem to be indispensable on earth. It is a great symbol of health. I have learned the great economic income of its products and the huge range of uses ranging from food, to clothing, shelter, being source of oil, milk, medicine, etc. All the way from the Asian Tropics to South and Central america *cocos nucifera* seems to always amuse not only for its beautiful physical attractive figure we see on beaches, but by its wide variation and types.

## 2.0 Ecology

### 2.1 Affinities

*Cocos nucifera*, popularly known as coconut palm or “Malayan dwarf” (Southern group of state foresters) belongs to the monocotyledonous family Arecaceae, also referred to as the palm tree family and the only living species of the “genus coco”(Encyclopedia Britannica). There are over 150 species of coconut palm extended over 80 different tropical & subtropical countries. The fruit that it produces(coconut), is the most utilized nut worldwide, consisting of a thick fibrous outer shell that surrounds the “embryo” composed mostly of meat called the copra and water. (University of Florida).This family gathers about 3400 species of palms distributed in the equatorial, tropical and subtropical regions of the world, perennial climbers, shrubs, acaules and are flowering plants in the monocot arecales (Ho Dinh Jai, 2017).” Coconuts are thought of as fruits because they’re sweet, grow on trees, and their liquids can be consumed in the form of coconut water.

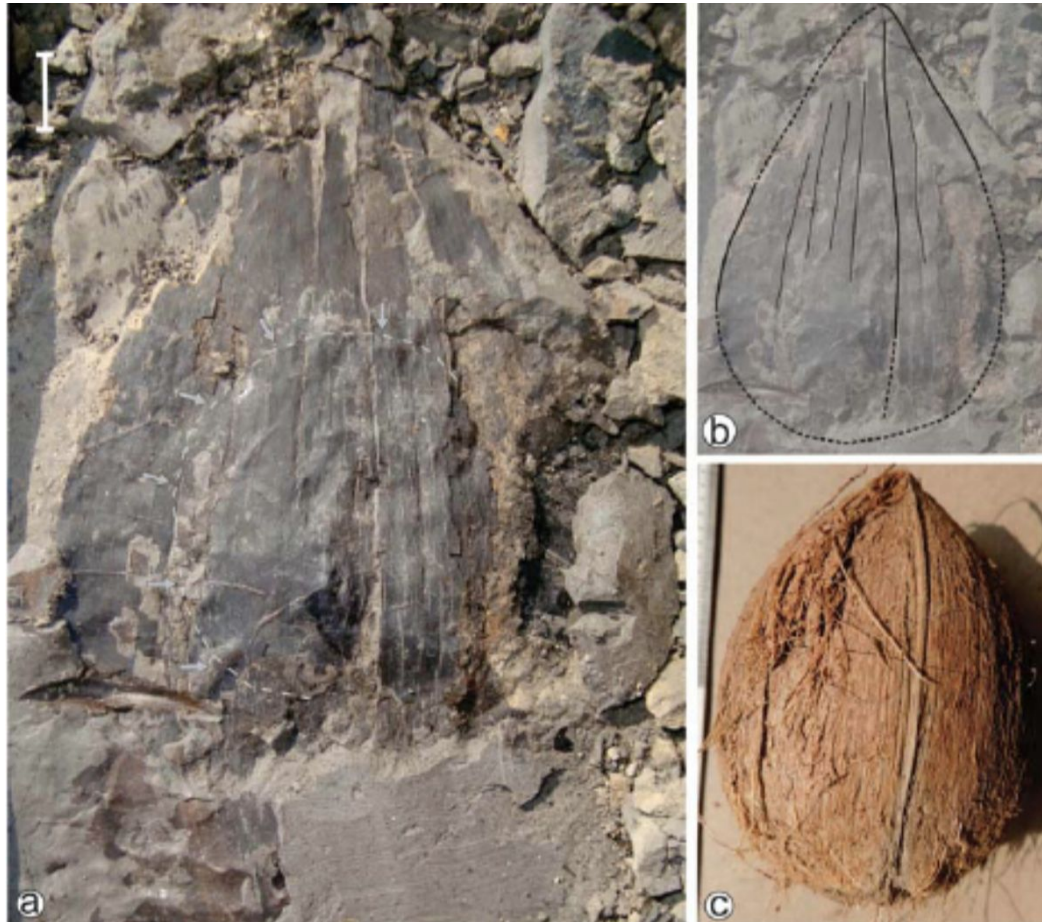
However, coconuts are also technically known in the scientific community as a nut and a seed. Coconuts can be classified as stone fruits, or drupes The United States Food and Drug Administration label coconuts as a tree nut, and companies when listing allergens have to specifically note the use of coconuts in the product. Meanwhile, the Food Allergy & Anaphylaxis Network (FAAN) considers coconut to be “the seed of a drupaceous fruit.””(https://www.eliyany.com/blog/2018/5/1/life-cycle-of-a-coconut)

### 2.2 Fossil Records

The oldest coconut fossilized fruit was first reported in the ancient eocont sediments of Ghansor( central india, fig. 2 ). Dr Rashmi from the Birbal Sahni institute of Palaeobotany, reported qualities of a “3 dimensionally preserved drupe”, the ovoid with visible ridges, husk with a thin exocarp and fibrous mesocarp from the maastrichtian geological time about 72-66

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million years ago (Fig. 1). The remains of cocos also found around plants as *Acrostichum*, *Nypa* palm, *Barringtonia*, etc, confirm the proximity of the sea to this area in the center of the country and indicates warm and humid conditions(Birbal Sahni Institute of Paleontology).



*Figure 1: Mesocarp of fossil fruit of Cocos nucifera*([https://www.researchgate.net/figure/A-Mesocarp-of-fossil-fruit-of-Cocos-sahnii-in-natural-size-B-Close-up-of-the-fossil\\_fig2\\_230741155](https://www.researchgate.net/figure/A-Mesocarp-of-fossil-fruit-of-Cocos-sahnii-in-natural-size-B-Close-up-of-the-fossil_fig2_230741155))

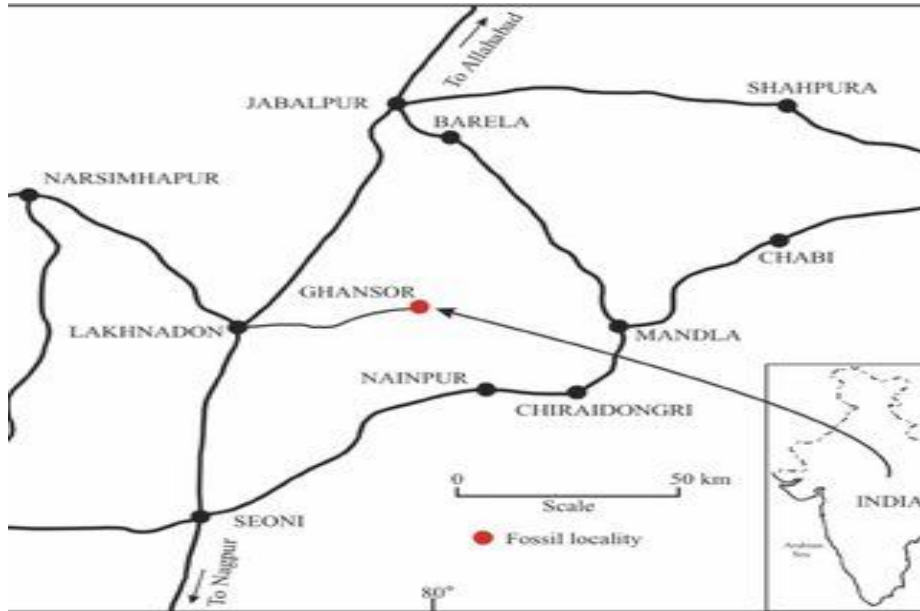


Figure 2: Fossil fruit movement and provenience

### 2.3 Origin

Coconut palm is one of the most important crops of the tropics, the origin hasn't been confirmed and there are various hypothesis concerning its origin, but is the most accepted and supported presumes cocos nucifera to be originated in two different locations; the pacific ocean coasts of southeast Asia & Malaysia and the Indian ocean (Maldives, Gujarat). Do to a very big differentiation in DNA of indian and pacific ocean coconuts, distinguishing the two origins. The pacific coconut including domestication traits of dwarf palms, self pollination. An exception to the second general Pacific/Indian split is the western indian ocean where the coconuts are a mixture of both. (CIRAD)

Coconut origin includes an extensive series of trade, colonization, cultivation and human voyages. DNA studies conclude that pacific cocos nucifera was introduced in indian waters by ancient Austronesians establishing trade routes between Asia, Madagascar and East Africa. Then it was transported by Europeans to the New world much later. (Agronomique pour le Développement). Pacific type coconuts are located in the pacific coast of central america, and the

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indian type ended up in the atlantic coast. Complete route in Fig.3.

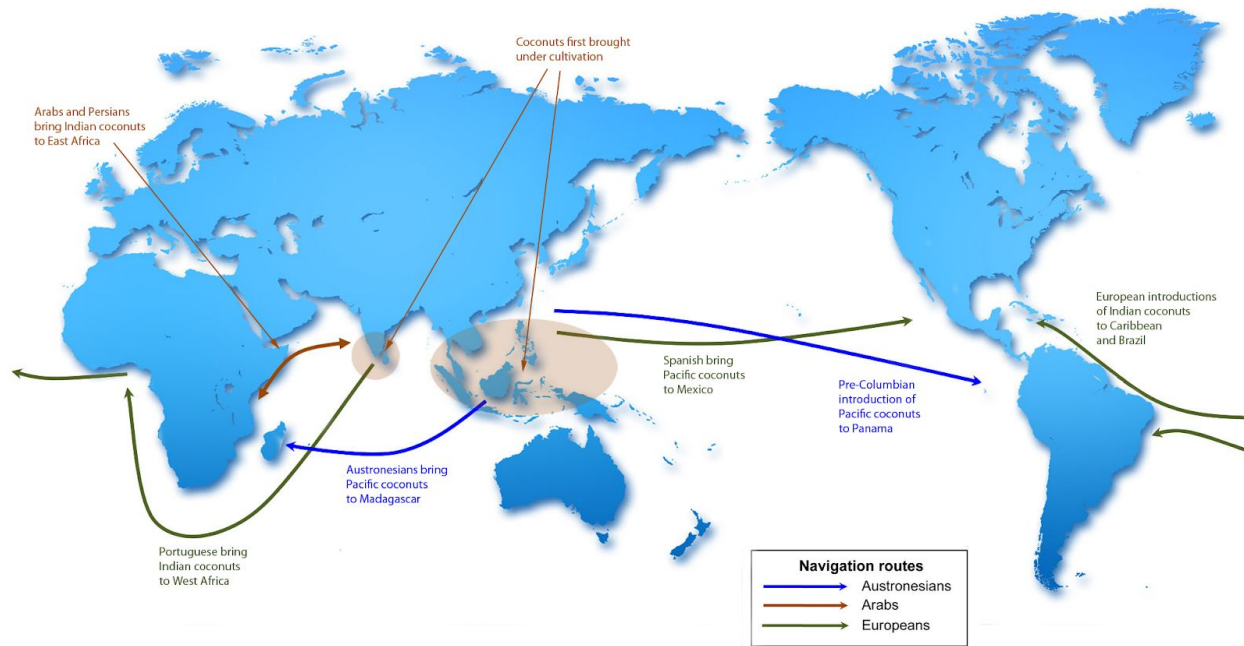


Figure 3: *Cocos Nucifera* origin routes

(<https://source.wustl.edu/2011/06/deep-history-of-coconuts-decoded/>)

## 2.4 Present Distribution

Today *C. nucifera* is grown in more than 80 countries; pantropical and subtropical regions. Mostly monodominant in atolls, islands and coastal regions, they are introduced inland by humans and are found in gardens, parks, plantations, at the side of the road. India occupies the predominant position in coconut production with Melanesia, South-East Asia, Malaysia, Indonesia, and Philippines (Chan and Elevitch, 2006; USDA-ARS 2015). This species is very common in countries across Asia, Africa, America and Oceania. Fig. 4 below demonstrates an accurate distribution of *C. nucifera* around the globe together with table 1.

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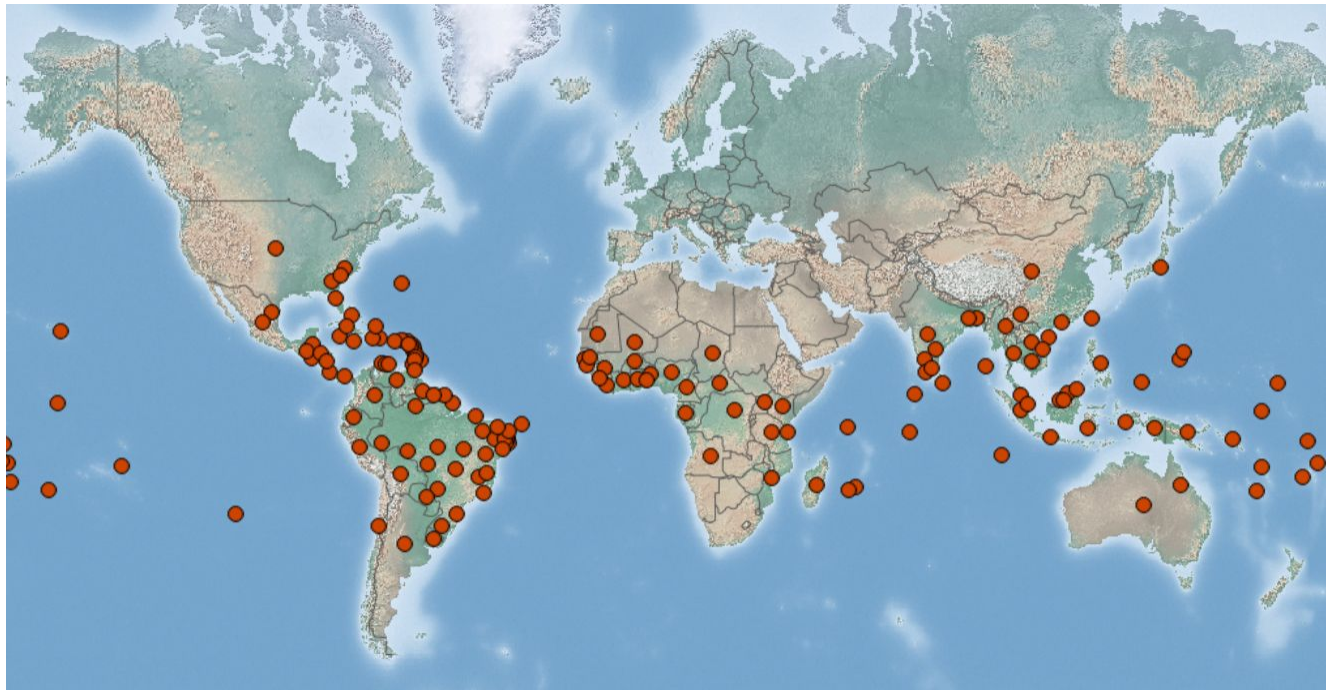


Figure 4: Current distribution of coconut in the World  
 (<https://wiki.nus.edu.sg/pages/viewpage.action?pageId=219427255>)

| ASIA       | AFRICA     | CENTRAL AMERICA        | SOUTH AMERICA | NORTH AMERICA | OCEANIA          |
|------------|------------|------------------------|---------------|---------------|------------------|
| Bangladesh | Angola     | Antigua and barbuda    | Colombia      | Bermuda       | New kaledonia    |
| Brunei     | Benin      | Anguilla               | Venezuela     | Mexico        | Fiji             |
| Cambodia   | Cameroon   | Aruba                  | Brazil        | Usa           | Guam             |
| China      | Chad       | Bahamas                | Argentina     | Hawai         | Palau            |
| Hainan     | Congo      | Barbados               | Bolivia       |               | Samoa            |
| India      | Gabon      | Belize                 | Chile         |               | Kiribati         |
| Indonesia  | Madagascar | British virgin islands | Peru          |               | French Polynesia |

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|             |          |             |            |  |                 |
|-------------|----------|-------------|------------|--|-----------------|
| Molucass    | Gambia   | Costa Rica  | Ecuador    |  | Nairu           |
| Japan       | Kenya    | Cuba        | Guayana    |  | Tokeau          |
| Sumatra     | Liberia  | El salvador | Uruguay    |  | Tuvalu          |
| Sabah       | Nigeria  | Mexico      | Paraguay   |  | Queensland      |
| Singapore   | Tanzania | Honduras    | Suriname   |  | Niue            |
| Phillipines | Uganda   | Jamaica     | Tocantines |  | Marshal islands |
| Thailand    | Togo     | Puerto Rico | Roraira    |  | Australia       |

**Table 1: demonstrates regions over the world were cocos nucifera is most concentrated**

### 2.5 Elevation

The optimum range of elevation in which the coconut palm develops successfully ranges from 0 to 400 meters approximately above the sea level, this is the range where commercial cultivation takes place. *C.nucifera* grows well in lowland tropical regions (far as 26°N) north and south of the equator (*Tropical plants database*) the maximum elevation is around 1,000 meters

### 2.6 Climate & Temperature regime

In order to assure successful blooming of the coconut palm, the cultivation requires warm weather without large temperatures variations. Temperature of a daily average of 27°C with variations in the range of +/- 5°C to 7°C is ideal. Due to the geographical distribution of the palm tree, its concluded that warm climate is the most favorable and optimal for its cultivation. Low or excessive atmospheric humidity is harmful for the tree (Ministerio de Agricultura y Ganadería E.S). Less than 60% relative humidity is reported to be noxious for the blooming purpose.

## 2.7 Geology and soils

The suitable soils for the plantation of *C. nucifera* are those with light texture from francs to sandy, alluvials, deep(1 meter $\leq$ ), with a surface water table 1-2 mts deep(ex:floors of the coastal plain), according to the *Journal of Vegetation Science*(2010). When the soil is satisfied with an irrigation type system, the crop can be carried out in “clay and silty”(silty considered best soil for agriculture) soils.

Coconut tree adapts thoroughly to soils where the water table is saline due to the great demand of chlorine of the palm, brackish water ends up being beneficial, and having an adequate drainage and aeration. Thrives between a wide range of soils, from coarse sand to clay or soil. Cocos makes part of the few crops that can be seen in the beaches or nearby. Although it adapts to a wide range of soils and a wide range of pH, it grows reproduces best at a pH of 5.5-7.

## 2.8 Family prominence and floristic elements

Cocos nucifera family prominence:

“Domain: Eukaryota

Kingdom: Plantae

Phylum: Spermatophyta

Subphylum: Angiospermae

Class: Monocotyledonae

Order: Arecales

Family: Arecaceae

Genus: Cocos

Species: *Cocos nucifera*”, (CAPI)

*Cocos nucifera* has an important key floral structure, at the age of 4 to 6 years they start producing male and female white flowers the difference being that female are longer, the number of flowers per spadix varies depending on the type of coconut palm. They're characterized by having plenty of sclerenchymatous tissue and idioblasts with raphides, silica bodies,androecium endothelium and endothecium (Acta Botánica Venezuelica) composed by a single layer of cells; gynoecium with intercarpellary septal nectaries and 3 bitegumented ovules.

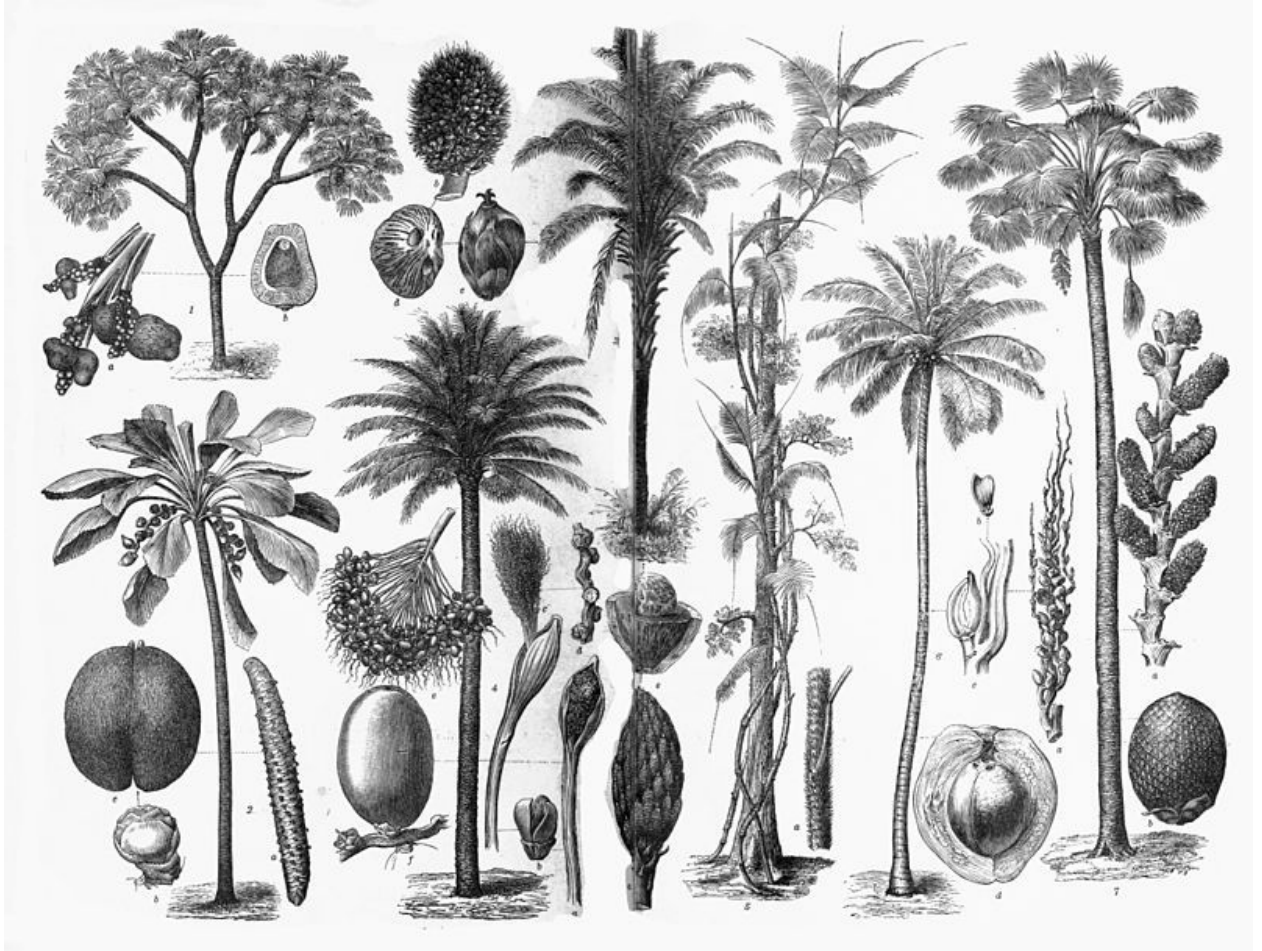
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Only 30%-40% are carried to full term with the white flowers, most are aborted within the three months of pollination. The anatomic traits that the flowers contain, work as a protection towards animal feedings and insects.

### **2.9 Associated species**

According to TNAU Agritech horticulture, *Cocos nucifera* forms part of the arecaceae, palmae family. This family gathers about 3400 species of palms distributed in the equatorial, tropical and subtropical regions of the world, perennial climbers, shrubs, acaules and are flowering plants in the monocotyledon arecales (Ho Dinh Jai, 2017). The associated species in this family are; coconut palm, areca palm, date palm, african oil palm, queen palm, trachycarpus fortunei, howea forsteriana, canary island date palm, chamaedorea elegans, acai palm, bismarckia, chamaerops, rhaps excelsa, livistona, pygmy palm, california palm, mauritia flexuosa, sabal, asian palmyra palm, borassus, cocos capitata, caryota, amongst others. Figure 4 below expresses some of these species, provinent from the same familie.

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*Figure 5: different types of coconut palm*

## 3.0 Biology

### 3.1 Community composition

This fibrous drupe fruit is generally presented in a oval-circle, sometimes octagonal shape. It is formed by the composition of 3 carpels. Regarding to the anatomic composition, the outermost component of *C.nucifera* is exocarp, thick-fibrous outer skin, to identify, in mature fruit is maroon and in mature fruit it is green or yellow (*asian & pacific coconut community*). Following the exocarp, comes the mesocarp acting as the the middle layer of the dupe between the exocarp and endocarp, the fibrous husk. After, comes the endocarp, described as the hardshell the meat (<4mm thick). Then, the testa, thin brown layer of seed-coat that covers the meat directly (<0.2mm thick). Following arises the kernel also known as meat. Finally in the center of the dupe take place the coconut water, liquid endosperm found in the cavity of the coconut. According to the *USDA*, National Nutrient database, the chemical composition contains various components. Vitamin B1 (*Thiamin*), 0.030 mg. Vitamin B2 (*Riboflavin*), 0.057 mg. Vitamin B3 (*Niacin*), 0.080 mg. Vitamin B5 (*Pantothenic acid*), 0.043 mg. Vitamin B6 (*Pyridoxine*), 0.032 mg. Vitamin B9 (*Folates*), 3 µg. Vitamin C (*Ascorbic Acid*), 2.4 mg.

### 3.2 Chromosome Complement

Coconut has a diploid chromosome complement of ( $2n=2x=32$ ) (<https://www.eliyanyc.com/blog/2018/5/1/life-cycle-of-a-coconut>)

### 3.3 Flowering and Pollination

Pollination in coconut is primarily affected by wind and insects. The size of coconut pollen is larger than that of most anemophilous pollens (20-40 µm) (Moore, 2001). Although entomophily is supposedly the predominant pollination mechanism (Holdt and Mitchell, 1967; Hedstrom, 1986; Henderson, 1986; 1988; Melendez-Ramirez et al., 2004; da Conceicao et al., 2004) prominent groove along the pollen grain is an adaptation for anemophily (pollen distributed by the wind). The coconut palm is part of the few plants that flower all through the year (Punjab & Haryana) Floral visitors include different insects and bats, the last one more unlikely but honey

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bee is the principal pollination in coconut gardens. They depend on coconuts more for pollen, than nectar.”A wider variation exists between ecotypes and geographic regions with regard to flowering phenology in coconut.”(Henderson 1988), the fruit occurs to be anemophilous with some geitonogamy occurring, all this also results benefic for the fruit, do to the fact it increases the yield, experiments by DR. Himachal Pradesh, demonstrate ut yields are higher were honey bees hives are kept.

Table 4. Coconut accession with Type III A flowering pattern (Direct autogamy)

| Sl. | Cultivar              | Male phase (days) | *Gap (days) | Female phase (days) | Intra overlapping- (days) | Inter overlapping- (days) |
|-----|-----------------------|-------------------|-------------|---------------------|---------------------------|---------------------------|
| 1   | Malayan Orange Dwarf  | 16.3              | 0           | 6.6                 | 6.3                       | 0                         |
| 2   | Malayan Yellow Dwarf  | 18.0              | 0           | 4.0                 | 4.0                       | 0                         |
| 3   | Chowghat Green Dwarf  | 16.0              | 0           | 5.0                 | 4.0                       | 0                         |
| 4   | Chowghat Orange Dwarf | 18.0              | 0           | 5.0                 | 4.0                       | 0                         |
| 5   | King Coconut          | 15.2              | 0           | 7.2                 | 6.5                       | 0                         |
|     | Mean                  | 16.7              | 0           | 5.6                 | 5.0                       | 0                         |

### 3.4 Life cycle and phenology

The agronomic features of *cocos nucifera* can be mapped in the life cycle of a coconut, *Figure 6*. According to the Food Allergy & Anaphylaxis Allergy Network, *Cocos Nucifera* seeds are horticultural, meaning they need to be germinated in order to evolucionado into a new plant(FAAN). A *cocos nucifera* seed cant take about 9 months before it starts to sprout, after several weeks the outer shell of the nut splits and a the root burts. Once the nut has sprouted it will grow in a quickened pace.()After approximately 4 months cocos nucifera sprout will reach a height of 2-3 feet.(FAAN) The palm will then take a expansion of 5 or 6 years (3 years for

dwarf) to start growing both male and female flowers in the same inflorescence, producing 12-15 per year of this. As a perennial tropical monocotyledon, the fruit will continue to grow and until it is ready for harvest or drop to start the propagation and germination process. The speed in germination varies depending on the different ecotypes and varieties. Usually 90% of seed fruits germinate and the other 10% is discarded, according to the APCC (Asian and Pacific Coconut Community, 1969) because of their pathogenic infection of the seed interior caused by the fracture of the shell.

### 3.5 Germination

In the process of embryogenesis, the haustorium begins its developing process. The cotyledon which is a “sweet spongy mass” which absorbs endosperm. The haustorium in order to facilitate the root growth in the germination process, splits the kernel and the coconut water as seen in figure 6. (coconut handbook 4.4)



**Figure 6: Germination of a mature coconut into a coconut seedling obtained from coconut handbook.**

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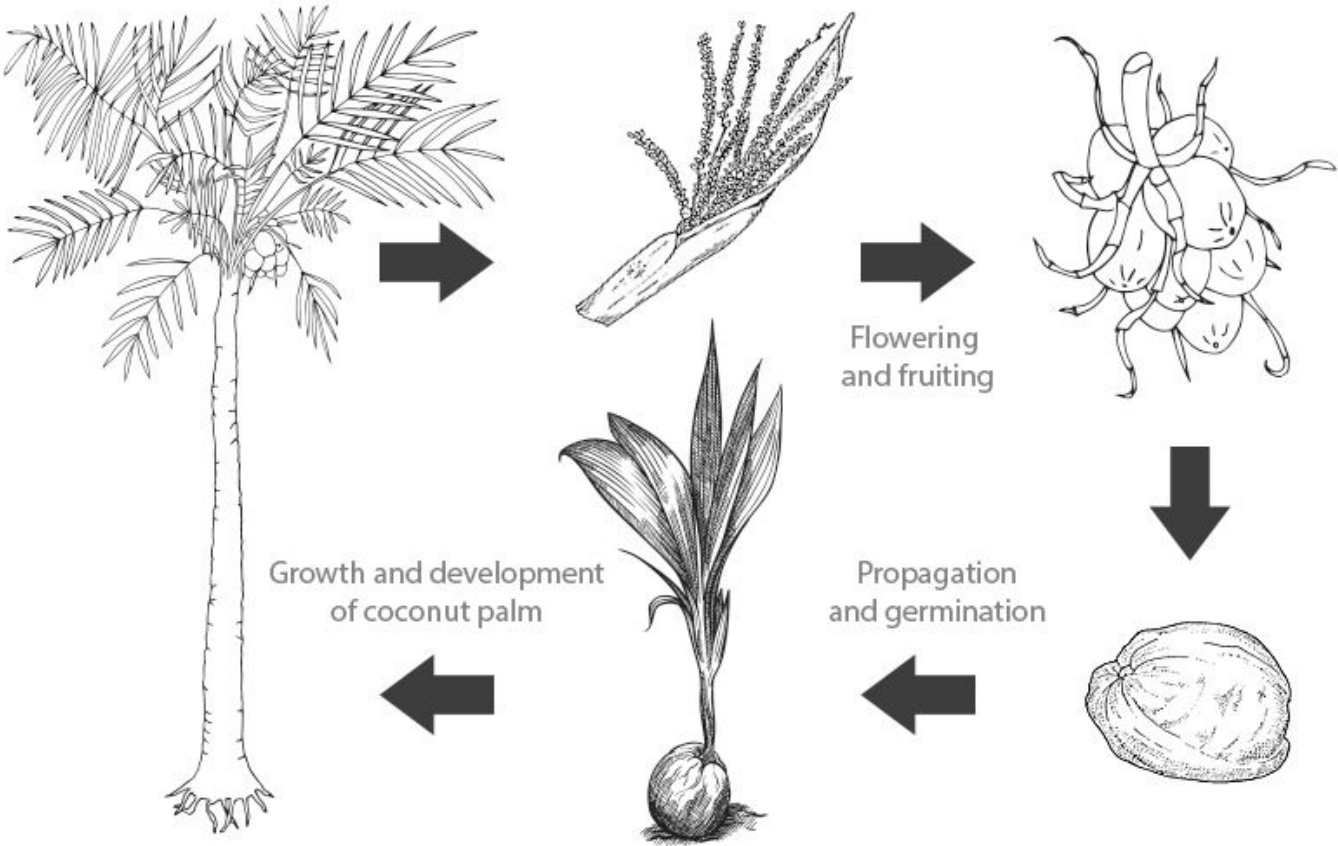


Figure 7: Life cycle of a coconut obtained from Coconut Handbook.

## **4.0 Propagation and Management**

### **4.1 Nut collection**

The propagation by seed nut happens when the seed acquires the needed maturity level, the husk loses moisture and the endocarp turns brown, and when shaken, it produces a sloshing sound. Indicating that volume (cm<sup>3</sup>) of the coconut aqua is decreasing. Seed nuts should be selected from a block of uniform palms producing an average of at least 1,500 nuts per ha every 45 days. This is equivalent to an annual 2.8 tons of copra per ha. Within this block, the selected mother palms should have at least 40-50 full-sized nuts, anytime of the year under ordinary farm conditions (Magat, 1999). *Cocos nucifera* organisms do not have a dormancy period between nut harvesting and germination, which minimizes metabolic activity and helps an organism to conserve energy.

### **4.2 Nut storage**

Due to the fact that they do not have a dormancy period, it is not prudent to store the nut for large periods of time. Malayan tall breed and the ones with accelerated germination are planted immediately unlike the varieties that have slower germination rates, as polynesian types and african types, the nut may be stored for approximately one month as long as the water in the cavity section does not arid. To hasten germination, storage can be do in ventilated spaces for a period of 2-4 weeks. Alternatively this may be picked at 11 month olds, and be stored in dry cold places for longer periods of time. (Fact sheet .178)

### **4.3 Nut planting**

Due to the fact that no pre-planting treatment is needed for *cocos nucifera*, the seed nut can be planted directly. Germination beds are used when there is a large quantity of nuts (coconut handbook 3,2). Early germinators are usually the best performers, while the slower ones (20%-30%) are discarded. This process is called “nursery”. In the second stage of nursery, the

nut is let to be grown until an acceptable size for nut planting. They are pried out, trimmed of exposed roots and planted back in the soil, upon germination.(Figure 7).



*Figure 8; coconut seedling being prepared for propagation (coconut handbook)*

#### **4.4 Nut transplanting**

The onset of the rainy season is the most appropriate time to transplant the designated seed nuts. The seedlings should be 8 to approximately 10 months old, when the seedling are still to young to be moves, their leaves are still succulent. For better results in the growth process, before being transplanted, each hole should be containing soil mixed with fertilizer. Experts from tetra laval group recommend, “ a small amount of organic matter like coconut husks can be placed at the bottom of the hole and covered with soil, leaving about one-third free for the seedling nut to ‘sit’.”. If there is a polybag seeding, the polybags shall be removed and the the seedind should be transplanted. After, the whole is to be covered with loose soil and the top of

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the nut should be 5-8 below the ground surface, deep planting soffocates the bud and shallow planting does not allow a stable position for the growing. There is a depression at he top of the crown in order to trap rain water.(<http://hort.ufl.edu/trees/COCNUCB.pdf>).

[https://www.researchgate.net/publication/281146388\\_Flowering\\_and\\_pollination\\_biology\\_in\\_coconut](https://www.researchgate.net/publication/281146388_Flowering_and_pollination_biology_in_coconut)

### 4.5 Disease Control

Cocos Nucifera has a wide variety of pests and diseases that affect its growth and development . Disease include Phytophthora spp, Ganoderma spp, Pestalotiopsis palmarum, Maramiellious cocophilus, pestalotiopsis palmarum. Pests include insects, oryctes

*Phytophthora spp* also known as bud rot and nutfall is a disease most susceptible between 14 and 40 year old palms, it occurs in all coconut growing regions and the disease is favored by high rainfall. It consists of chlorosis in leaves, foul smell, pink lesions and infected inflorescences abort nuts caused by oomycetes. Its treatment control bases primarily in having good sanitation and the use of systemic fungicides in order to remove the infected debris from the plantation or the practice of irrigating trees early in the day to allow the surfaces to dry.

*Ganoderma spp* also known as Ganoderma butt rot is caused by fungi and its symptoms vary from old fronds becoming yellow and wilting and dropping to the fronds be collapting and dying, the internal tissue of the lower stem is discolored and its noticable the overall reduction in the vigor of the plant. Its is managed by fungicides.

*Chalara Paradoxa* commonly known as stem bleeding disease is also caused by fungus and it consists on a soft, yellow rot on the trunk, the infected areas turn dark and black and a reddish-brown liquid oozes from the rooting as seen in *figure 9* . It is treated by using machinery and tools to reduce disease incidence and applications of fungicide benomyl, infected trees should be removed and destroyed(Plant village)



*Figure 9: Stem bleeding on a coconut trunk*

#### **4.6 Pests Control**

Cocos nucifera mayor pest is the *Pseudotheraptus wayi* also known as the Coconut bug, a brownish insect with well developed wings. Causing damaged and aborted flowers, necrotic lesions, scars on nuts and may cause young nuts to die, the coconut bug is a great threat for coconut palm in africa, 2 of this bugs per calm can cause grave damage. The most effective management for this issue are the weaver ants, they effectively exterminate this bug.



*figure 10: Cocunut pupa*

*Oryctes rhinoceros* also known as Coconut rhinoceros beetle cause V shaped cuts in palm fronds and holes in the leaf midribs(Plant Village). Treatment consist in destroying any decaying logs in the plantation and burning the larvae that is probably inside. Extracting larvae from the

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crowns with wire as seen in Figure 11 or planting a “cover crop” to decrement egg laying, due to the fact females do not lay eggs in vegetated areas.



*Figure 11; Lure and trap for coconut rhinoceros beetle*

## 5.0 Emerging Products & Markets

### 5.1 Emerging products and Potential Markets

One of the main reason coconut and it's products fall in price, is because their dependence on coconut oil price, which depends in the other vegetable oils. The industry has been successful in evolving adequate technologies for some of the value-added products of coconut. As consequence, coconut product variations such as packed coconut milk, creams, milk powder, virgin coconut oil, coconut chips, coconut vinegar, coconut jaggery, coconut sugar, between others, have good commercial potential and have been developed, according to the book *The Coconut Palm- Research and Development Perspectives*. This products become a agro-based raw material with great importance for various industries making it possible to encourage product diversifications and advance in value-added products in industry.(Nampoothiri)

### 5.2 Nutritional Values

According to science direct, coconut has a great amount of dietary fibers and mineral nutrients. It is a rich source of phenolics and antioxidants.

The United States Department of Agriculture states that coconut water has a caloric value of 17.4/ 100 g, it contains vitamin B, pantothenic acid B5(0.5 $\mu$ g/ml), nicotinic acid B3, biotin(0.02 $\mu$ g/ml),riboflavin B2 vitamin E, folic acid (0.003 $\mu$ g/ml), thiamine B1, pyridoxine B6, sugars.sugar alcohols, vitamin C, folic acid, amino acids, phytohormones (auxin, 1, 3-diphenylurea, cytokinin), enzymes (acid phosphatase, catalase, dehydrogenase, diastase, peroxidase, RNA polymerases) (USDP).

The kernel which is primarily used for oil extraction contains 65%-75% oil. Jaggery, vinegar and sugar is produced by the unopened spathe. Dessicated coconut composition is expressed in chart 1.

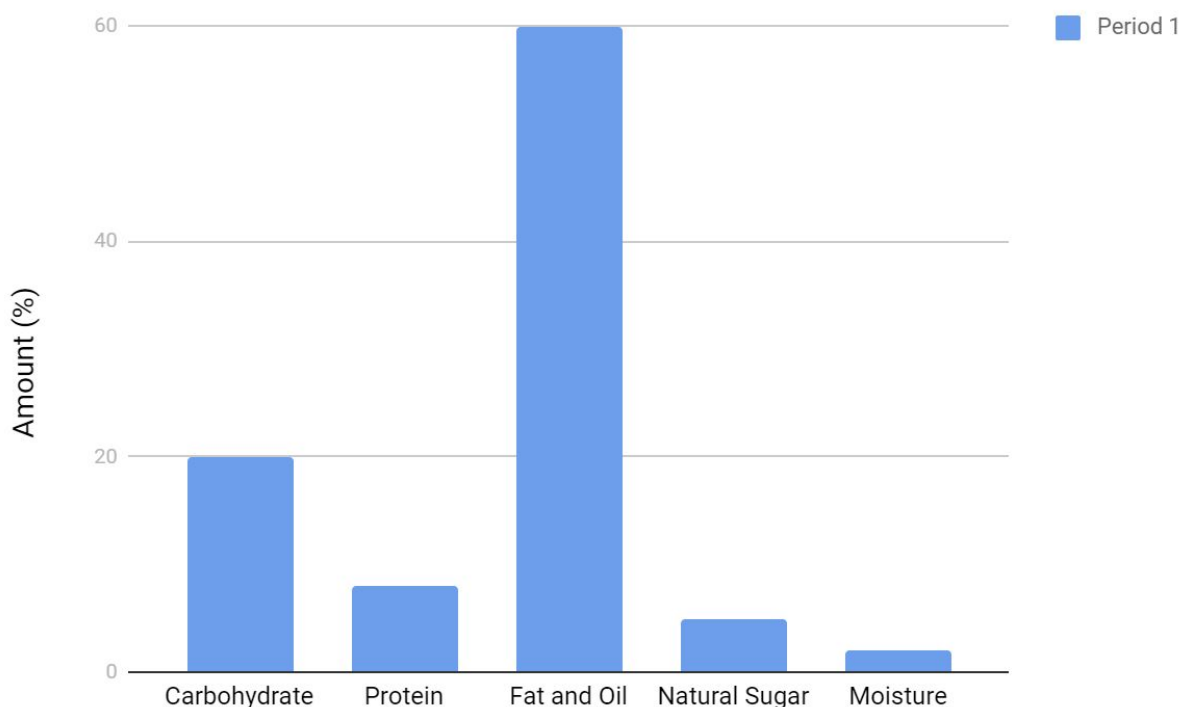


Chart 1: Percentage amount of component in coco oil

### 5.3 Medicinal Uses

It is used as antibacterial, antifungal, antiviral, antiparasitic, antioxidant, hypoglycemic, antiparasitic, immunostimulant and hepatoprotective. As an antidote, *cocos nucifera* is used to eliminate poisons due to dosage or toxicity. It absorbs the drug and makes the peak concentration in blood more simple by the electrolytic effect, similar to fructose coupled faster absorption in cells and body". (GS Effiong). Coconut nutrients significantly reduce lipid peroxidation and increasing antioxidant enzymes. In its cardioprotective effect, it allows fatty acids to be directly absorbed from the intestine and be sent to the liver in order to be rapidly metabolized for energy production. According to Dr. Nevin Rajamohan. "Coconut water has cardioprotective effects in myocardial infarction due to rich content of mineral ions like it, is potassium". VCO lowers cholesterol and lowers risk of heart disease raising HDL (good cholesterol), triglycerides, phospholipids, low density lipoprotein. Virgin coconut oil is found to prevent *in vitro* LDL-oxidation. As in weight loss matters, the medium-chain triglycerides present

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in coconut oil, speed up energy usage and the MCTs digest as fast as sugar in the body(Rinehart).

In moisturizing matters, coconut is one of the best components a moisturizer may have, because of its vitamin E, it plays a positive antioxidant action in the body, preventing damaged tissues and oxidation that causes aging. Coconut oil provides a certain type of secondary fuel source apart from glucose, that the nervous system and brain can function on. According to Dr. Rinehart, in alzheimer (described as type 3 diabetes,)for example the brain blocks glucose uptake wich can lead to general neurodegeneration.

### **5.4 Edible and various uses**

For proving the coconut worth its necessary to identify if its mature or young. Mature coconuts are brown and hairy and have more meat than water, in the other hand, young coconuts have white husk or green shell and have larger amounts of coconut water and softer meat (Dr. Mercola 1997). Almost every single part of the coconut palm and fruit are utilized in the market: coconut husks, shells, leaves, trunk, roots, meat, water, leaves, coir, etc.

For edible purposes, coconut is a very versatile fruit that can be presented in forms like the nut/seed, nut milk, palm heart, oil, apple, etc. Its versatility permits it to be eaten either cooked or raw the meat of the *cocos nucifera* meat is often scratched and dried to use in cakes, pastry and sauces.

From the coir, the elastic fiber extracted from the husk and placed as the outer shell, it is often extracted products as mats, brushes, ropes, stuffing for mattress and caulking

The kernel(meat) is primarily utilized in the production of curries, toffee, chutney and sweets, coconut oil can be extracted from this, as coconut milk, nectar, copra, meera, palm wine, serum, candy and sugar.Coconut milk and oil are indispensable.are a traditional indispensable in African and Asian bakery. “Traditionally extracted by grating the kernel, macerating with water and boiling it”(Ferm,2014) Oil is used in baking and in machinery, margarines, milk, ice cream.

Coconut water is popularly consumed by itself and become really popular because of its authentic delicious flavor, but it can be used to produce nata de coco, coconut wine and vinegar.

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From the husk and shells, people in Asia and India popularly use them as pots for plants, they use them to create bowls, instruments and even exfoliating products. They are often used as a source of charcoal and fuel and repellent.

Coconut leaves are adapted into brooms, baskets, cooking skewers. Coconut trunk is often used for furniture, canoes and instruments and finally the roots are used to create dyes and mouthwashes.

There are different adaptations of the coconut in every part of the world. In Philippines is often used as a bunot and lambanog also known as coconut vodka, in Jamaica as a coconut brush, made from the shell and the roots. In Malaysia is used as tempuying. In Kiribati is used to make the popular drink karewe derived from coconut sap.

### **5. 5 Imports and Exports**

The top producer of *cocos nucifera* is Indonesia producing an approximate of 183,000,000 tonnes annually, followed by Philippines which produce 153,532,000 tonnes, then India with 119,300,000 tone, after Brazil producing 2,890,286 tonnes and finally Sri Lanka to wrap up the top 5 producers, producing 2,513,000 tonnes. The top exporter is Philippines with an export value of \$856.58 M yearly. The top importer being China, importing \$856.58 M yearly.

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