

# **COCONUT**

**Dr. P. K. Yadav**  
**Professor and Head**

# Table of contents

- Introduction
- Origin
- Composition and uses
- General morphology
- Species and cultivar
- Eco-physiological requirements
- Propagating materials
- Nutrient management
- Water management
- Weed management and inter cropping
- Harvesting
- Yield
- Major Insect pest and disease of coconut

# Introduction

The coconut tree (*Cocos nucifera*), is a member of the family **Areaceae**. Generic name derived from Spanish word “coco” means monkey face or skull/head. Every part of the tree is useful to human life for some purpose or the other. Hence, the coconut palm is endearingly called ‘**Kalpavriksha**’ meaning the tree of heaven. The copra obtained by drying the kernel of coconut is the richest source of vegetable oil containing 65 to 70 per cent oil. Coconut have chromosome number  $32(2n=32,x=16)$  and edible portion of coconut is **endosperm** with fruit type **drupe**.

## Origin and distribution

Origin of coconut is believed to be somewhere in **South–East Asia**, most probably in **Malaysia or Indonesia or Indian ocean**. Having originated from south East Asia it later moved further America, West Indies, Caribbean sea, Portugal, Arab on the African coast.

## Area and Production in India

Year	Area ('000 ha)	Production ('000 Mt)	Productivity (kg/ha)
2009-2010	1895.20	10824.00	5711
2010-2011	1895.90	10840.00	5718
2011-2012	2070.70	14940.00	7215

India rank 3<sup>rd</sup> in the world on production of coconut after Indonesia and Philippines but India rank 1<sup>st</sup> in the productivity in the world.

Kerala share coconut production highest(45%) followed by Tamil Nadu(22%), Karnataka(12%) in India.

Source: CDB, India

# Nutritive value and Uses of Coconut

The following products of coconut are useful to human being.

- 1) Coconut water** : It increases bold circulation in the kidneys and cause profuse dieresis.
- 2)The Wet Meat or Kernel:** The kernel is an important article of food being used in culinary purpose.
- 3) Desiccated Coconut:** It is dried out disintegrated coconut meat. It has great demand in confectionary and other good industries.
- 4)Coconut oil and Oil cake** : Dried copra gives 60 to 67% oil and 33-40% oil cake. The coconut oil is in great demand for edible purposes, for soap making toilet preparation. The oil cake is used to feed cattle and poultry.

Edible portion	Fresh Kernel	Dry kernel	Nut water
Protein	4.1%	8.9%	0.2%
Fat	37.3%	67%	0.1%
Carbohydrate	7.9%	12.4%	5.6%

**FRUIT**

Shredded Coconut

Coconut Water

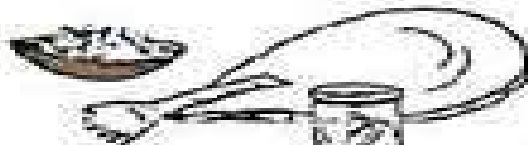
**HUSK**

**SHELL**



Scraper

Fish Hook



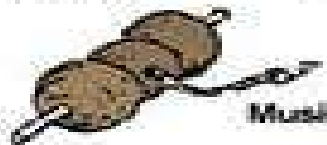
Coconut Cream



Coconut Meat



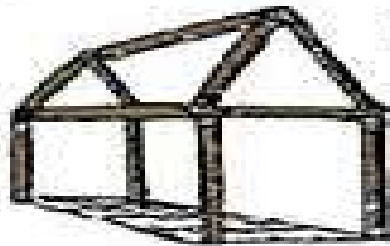
Kindling



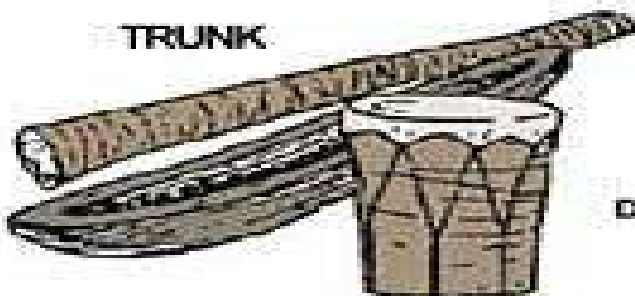
Musical Instrument

Posts

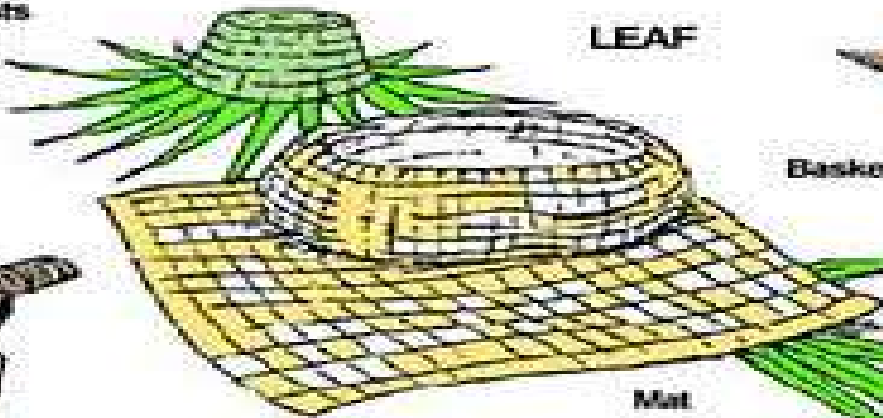
**LEAF**



**TRUNK**



Drum



Mat

Basket

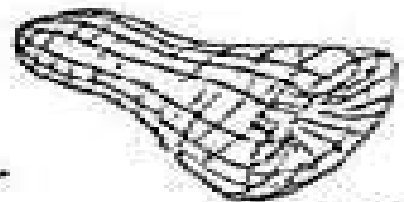
Lashing



**SPATHE**

Container

Mat



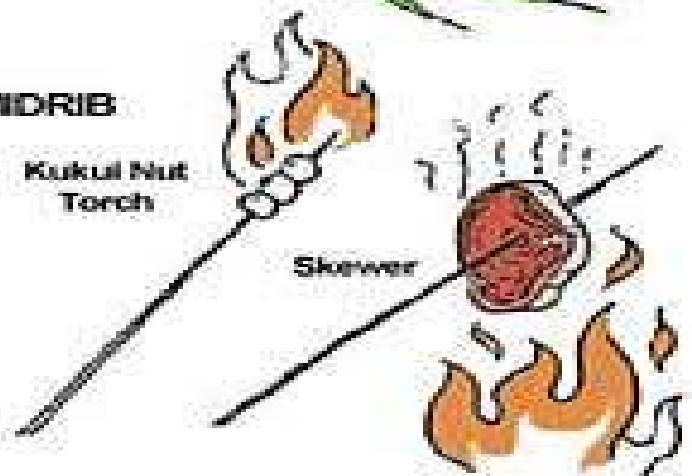
Fish Trap

**LEAF BUD SHEATH**

**MIDRIB**

Kukul Nut Torch

Skewer



## Botany:

Palm is a tall, stately unbranched, growing to the height of 12m to 24m. The stem is marked by ring of leaf scar which are not prominent at the base.

The palm has adventitious root system having numerous thick roots from base of the stem almost throughout lifetimes and roots are localized, generally at the lowermost region of stem which has been termed as "bole."

Leaf are large, long, pinnatisect, borne on the crown. Palm is monocious with few female flower. Inflorescence is spadix which is about 1.2 to 1.8 m long, stout, erect, straw or orange colored and simply branched.

Fruit is large, one seeded drupe. The outer layer of pericarp are thick and fibrous. The inner layer (endocarp) is hard and thin testa cohering to endocarp is lined with white albuminous endosperm enclosing large cavity partially filled with sweet fluid.

53.5 Coconut roots

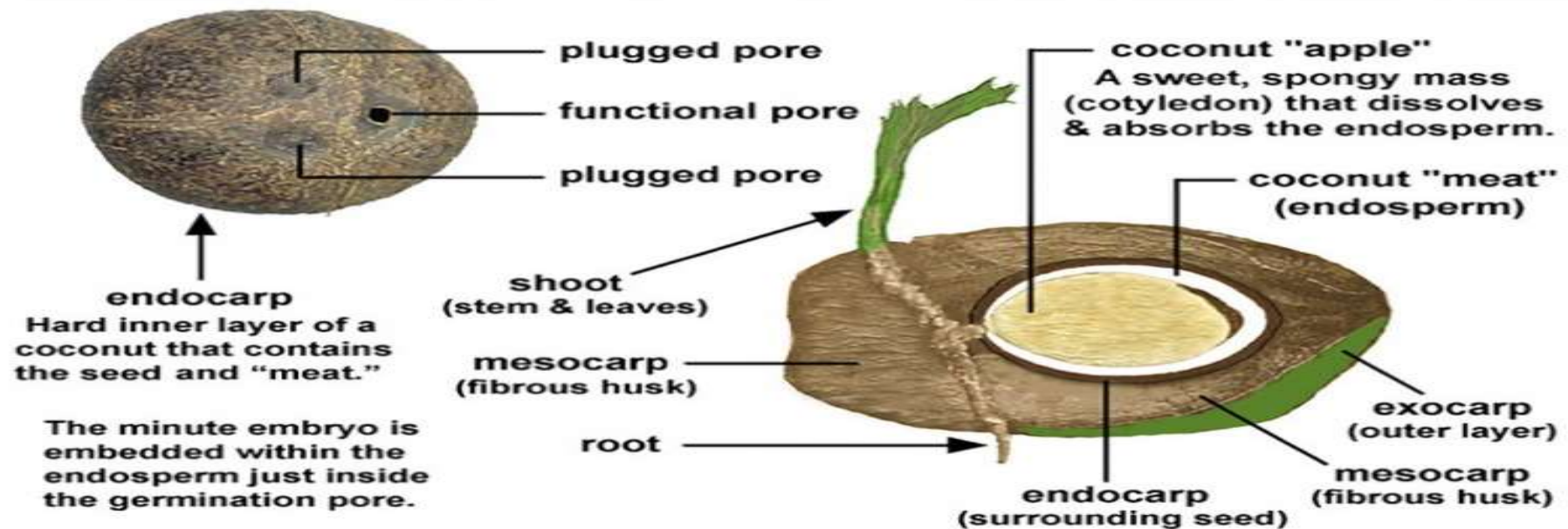
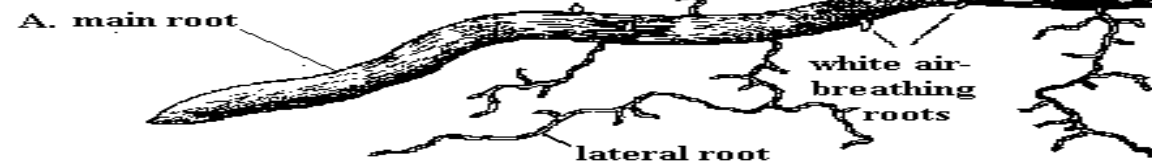


Photo-Illustration of a Germinated Coconut



## Species and Cultivar

**Species:** The genus *Cocos* is a monotypic one have only species of *Cocos nucifera*.

**Cultivars:** Coconut have two distinct cultivars , the tall and the dwarf.

### Tall cultivars

West Coast Wall, Lakshadweep Ordinary, Lakshadweep Micro, Kappadam tall, Kampura, Spicata, Andaman ordinary tall, Laccadive ordinary tall

### Dwarf cultivars

Dwarf Green, Dwarf orange, Chowgat Green Dwarf, Malayan Green dwarf, Mayalan Orange Dwarf, Gangabondam Dwarf,

**Hybrid:** DXT, Kalpasankara, Kalpashree, Anand Ganga, BHC-1, Kera Hybrid

### Eco-physiological requirement

- **Climate:** It is essentially a tropical plant growing mostly between 20°N 20°S latitudes. Rainfall of about 2000 mm per year, well distributed throughout, is ideal for proper growth and maximum production. It grows well at the range of temperature 22°c -32°c.

**Soil:** Coconut is adaptable to a wide range of soil condition from light sandy soils to heaviest clays with a PH ranging from 5.2 to 8. Best soil are deep, friable and loamy and heavier soil require good drainage.

**Propagating materials:** In coconut propagation is done by seed. Vegetative propagation is not commercially exploited. First we have to select seed nut and their plantation on nursery and finally transplanted on main field. Following steps are involved for propagation of coconut.

**Mother Palm Selection:** Good mother plants is identified by the following traits:

a) Crown should be spherical or semi spherical for selection & drooping or erect crown should be avoided

b) High yielding mother palms giving not less than 100 nuts/palm/annum

c) Palm should have 30-40 fully opened leaves and 12-15 bunches with a high setting female flower.

d) Regular bearer & should be in the age group of 25-50 years.

e) Palm should be free from pest and diseases.

f) Husked nuts should weigh not less than 600 g & Mean copra content of 150 g per nut or more.

## **Maturity of Seed Nut:**

The mature nuts are harvested when at least one nut in the oldest bunch starts becoming dry. In Tall varieties, it takes 11-12 months to become a matured seed nut whereas in dwarfs, nuts will mature in 10-11 months after emergence of the inflorescence. They produce a resonant and ringing sound when hit while Immature nuts will produce a dull sound.

## **Selection of Seed Nuts:**

Harvest at the month of Feb.-Aug. in Tamil Nadu and Dec.- May in Karela to get maximum germination. Tall varieties are sown one or two months after collection whereas dwarfs should be sown immediately after harvest (within 10 to 15 days).

For more quality of seedling seed nut are air cured and followed by sand cure for 2 month.



## **Nursery Area:**

Select nursery area in a well drained plot with coarse texture soil near water source for irrigation. Nursery can be raised in the open space with artificial shade or in the adult coconut garden.

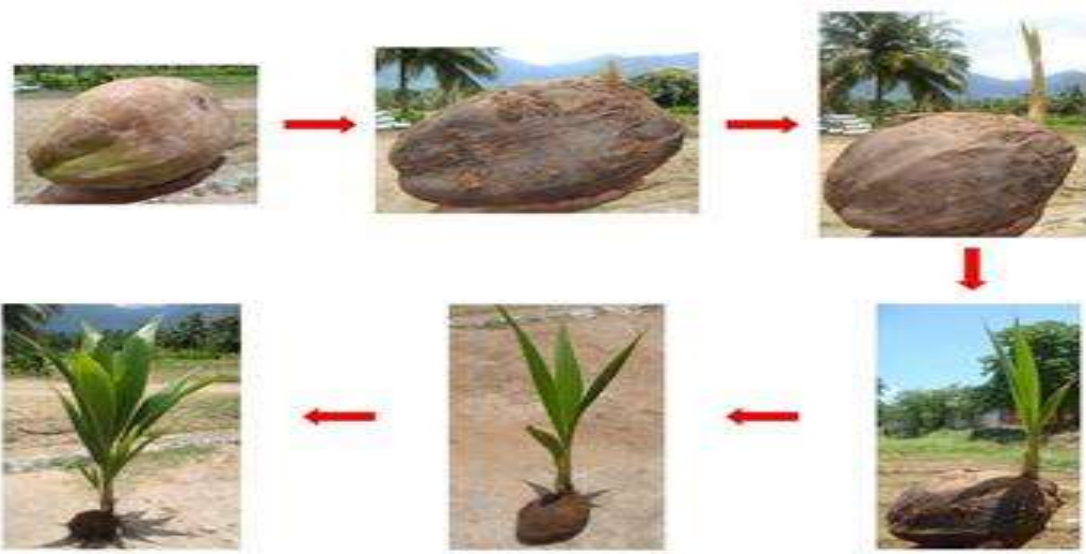


**Seed Nut Planting:** Plant seed nuts in a long and narrow bed at a spacing of 30 x 30 cm either horizontally or vertically in deep trenches with 20-25 cm depth. Five rows of nuts may be planted in each bed accommodating 50 nuts per row.



**Selection of seedling:** Select the seedling about 9-12 month after planting. Well germinated seedling good girth at collar early splitting of leaflet are good. Seedling should be free from pest disease and healthy Root system.



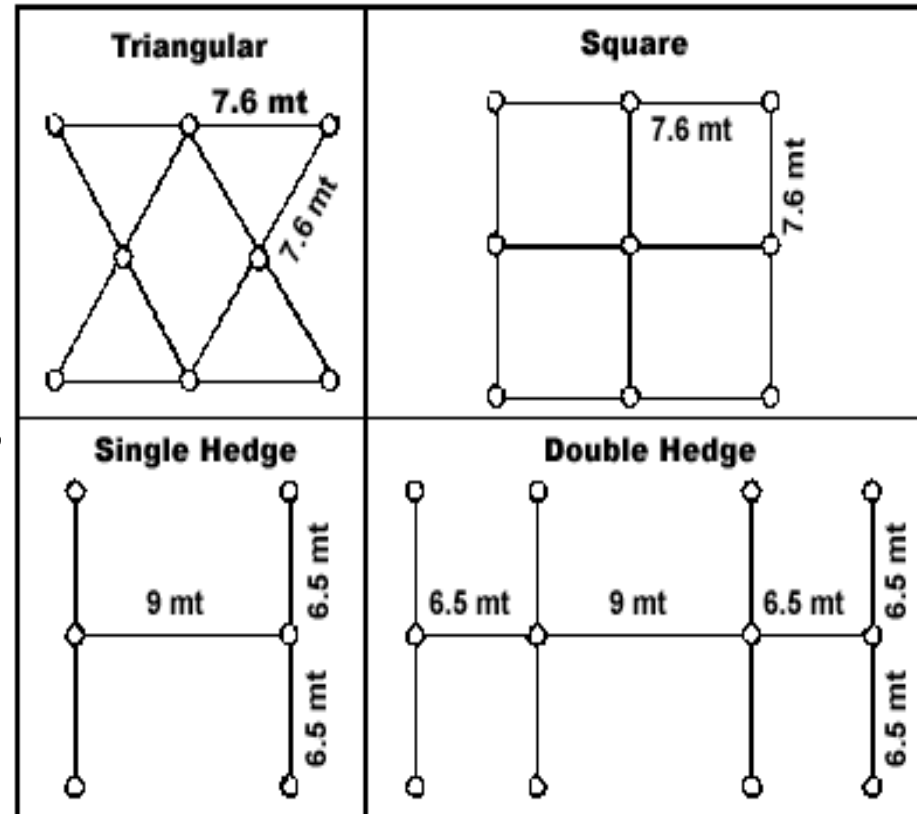


**Seed to seedling**

**Healthy rooting**

**Planting system Spacing**

1. Triangular: 7.6m
2. Square: 7.6x7.6m, 8x8m, 9x9 m
3. Single hedge: 6.5m in rows - 9m between rows
4. Double Hedge: 6.5 to 6.5m in rows - 9m between pairs of rows



## **Planting**

**Dug pit size of 3' x 3' x 3'. In the pits, sprinkle Lindane 1.3 % D to prevent white ant damage. Fill the pit to a height of two feet (60 cm) with FYM, red earth and sand mixed in equal proportions. At the center of the pit, remove the soil mixture and plant the seedling after removing all the roots.**

**Irrigation:** The irrigation requirement varies according to the soil type and climatic condition. Generally, an adult palm requires 600 to 800 litres of water once in four to seven days. Irrigate in basins of 1.8m radius and 10-20 cm depth. when once started irrigation should be continued regularly and systematically. Drip irrigation in coconut is the best method of irrigation in the coconut which saves water, money and labor.

## **Drought management and soil moisture conservation**

- a. Mulching with coconut husks/leaves/coir pith**
- b. Burial of coconut husk or coir pith**

**Manuring:** Apply manures and fertilizers in circular basins of 1.8 m from the base of the palm, incorporate and irrigate. The fertilizers may applied in two split doses, in June – July and in December to January.

Age(years)	FYM(Kg/tree)	Urea(kg/tree)	Super phosphate(kg/tree)	Murate of potash(kg/tree)
1	10	0.308	0.500	0.480
2	20	0.616	1.000	0.960
3	30	0.924	1.500	1.440
4	40	1.23	2.000	1.920
5 <sup>th</sup> year and onwards	50	1.23	2.000	1.920

### Organic Recycling

Anyone of the green manure crops can be grown and plowed in situ at the time of flowering. Coir pith compost or vermi-compost can be used as manure



## Weed management:

The inter-space in the coconut garden has to be ploughed twice in a year in June - July and December - January. For the broad-leaved weeds, pre-emergence spraying of atrazine @1.0 kg a.i./ ha for the control of grasses and sedges. Post emergence spraying of glyphosate @ 10 ml and 20 g ammonium sulphate/litre of water.

## Inter cropping:

Inter/mixed crop is selected based on the climatic requirement of the inter/mixed crop.

**a. Below 7 year of age:** Any suitable annual crop for particular soil and climatic condition may be raised upto 5 year of planting. eg: Banana, Sunflower, Groundnut, Turmeric etc.

**b. 7-20 years of age:** Green manure crops and fodder crops like Napier grass and guinea grass.

**c. Above 20 year:** Intercropping can be done based on the sunlight transmission on its canopy. Annual, Biennials and Perennials plant can be grown.



# Inter cropping images:



## Harvesting:



- Twelve months old nuts are harvested at the interval of 30-45 days for seed as well as copra making and culinary purposes. For household use keep the nuts in vertical direction. However, for tender nut purposes 7 to 8 months old nuts are harvested. The nuts can be harvested using coconut climbers.
- Nuts which are 11 months old give fiber of good quality. In case of tall the nuts harvested for seed purpose can be stored for 2 to 3 months period before sowing, whereas in case of dwarfs and hybrids, nuts should be sown within a period of 10 –15 days of harvest.



### Yield:

S.No	Variety	Nut yield(Nos/tree/year)
1	Hybrid	100
2	Tall	60-80
3	Dwarf	70-90

# Pest and Disease

Pest	Symptoms/Damage	Control
<p data-bbox="92 248 324 462"><b>Rhinoceros Beetle</b> (<i>Oryctes rhinoceros</i>)</p> 	<p data-bbox="479 248 1182 462">The adult beetle bores into the unopened fronds and spathes. Attacked fronds when fully opened show characteristic geometric cuts</p>	<p data-bbox="1290 248 1839 691">Spraying 0.01% Carbaryl (50WP) in the breeding sites of the beetle help destroy the larva. Biological control using the virus Baculovirus oryctus (release 10 - 15 virus infected beetles in 1 ha)</p>
<p data-bbox="92 823 432 981"><b>Red Palm weevil</b> (<i>Rhynchophorus ferrugineus</i>)</p> 	<p data-bbox="479 823 1248 1038">Presence of holes on the stem, oozing out of viscous brown fluid and extrusion of chewed up fibres through the hole.</p>	<p data-bbox="1290 823 1823 1152">Practice clean cultivation and avoid the injury to the stem. Use pheromone trap for attack of insect. Inject attacked palms with 1% Carbaryl (20gm/litre).</p>

# Cont.....

## Black headed Caterpillar (*Opisina arenosella*)



They eat the green matter of the leaves and live under surface of leaflets.

Release of parasitoids like *Gorriozus nephantidis*, *Elasmus nephantidis* and *Brachimeria nosatoi*. Spray the under surface of leaves with 0.02% Dichlorvos (Dichlorvos 100EC).

## Coreid Bug (*Paradasynus rostratus*)



The attacked buttons do not develop resulting in immature nut fall. The nuts if developed may become barren.

Spraying has to be done 3 times a year. Apply 0.1% Carbaryl on the inflorescence after the receptive phase of the female flower.

## Rats



Attack tender nuts resulting in immature nut fall.

Use poison bait with zinc phosphate. Use rat traps. Entry of rats on to the trunk can be prevented by fixing mechanical barriers upto 2m height from ground level using 40cm sized G.I. sheets.

<p><b>Bud Rot:</b> <i>Phytophthora palmivora</i></p>	<p>The earlier symptom is the yellowing of one or two younger leaves. Black spots appear on spindle leaves. In the later stages the spindle withers and drops down.</p>	<p>Spray 1% Bordeaux mixture on the crown of the neighbouring palms as a prophylactic measure. Spray with 1% Bordeaux mixture during May and September if the disease occur frequently.</p>
<p><b>Stem blending:</b> <i>Ceratocystis paradoxa and Chalara paradoxa</i></p>	<p>Exudation of reddish brown liquid through cracks developing on the stem. Decaying of tissue at the bleeding point and development of big holes inside the trunk.</p>	<p>Avoid any mechanical injury to the stem. To avoid the spread of disease onto upper trunk, root feeding with 5% calixin may be adopted on May-June, sept.-oct. and jan.- Feb.</p>
<p>Thanjavur wilt (<i>Ganoderma lucidium</i>)</p>	<p>Decay of root system, browning of outer leaves, appearance of bleeding patches on stem and arrest fruit set.</p>	<p>Apply 5 kg of neem cake per year, providing organic matter and irrigation.</p>


<p><b>Mahali</b> <i>Phytophthora palmivora</i></p>	<p>Shedding of female flower and immature nuts. Lesions appears on the young fruits or buttons near stalk which later result in decay of underlying tissue.</p>	<p>Spray 1 % bordeaux mixture on the crown of palmonce before the monsoon and later after 40 days interval.</p>
<p><b>Leaf blight or grey leaf spot:</b> <i>Pestalosia palmivora</i></p>	<p>Minute yellow spots encircled by greyish bands appear on the surface of mature leaves of outer whorl. complete drying and shrivelling of the leaf blade are common when the infection is severe.</p>	<p>Spraying the foliage with 0.25% Copper oxychloride will check the spread of the disease Spray the trees with 1% Bordeaux mixture or spropiconazole 0.3%.</p>

### The many Uses of the coconut tree / part 1

*(Bhavprasad)*

**Parts and Uses**

- \*The trunk of the coconut tree: building material, canoes, poles, rafters and fences.
- \*The huge leaves are woven together to make thatched roofs.
- \*The fibrous husk of the coconut: cushions mattresses, ropes, brushes and stuffing fiber.
- \*The central thick midribs of the coconut leaves: baskets, mats, for tying logs together and many other household items.



## THE BENEFITS OF COCONUT WATER


PositiveMed

- ▶ MINERALS
- ▶ VITAMINS
- ▶ ELECTROLYTES
- ▶ ALKALIZES SYSTEM
- ▶ AIDS DIGESTION
- ▶ HELPS WITH DIABETES
- ▶ ANTIBACTERIAL
- ▶ ANTIFUNGAL

PositiveMed

**DID YOU KNOW?**

Coconut water was used in the 2nd World War as a blood substitute when blood plasma was low



# References

- Thampan, P.K., 1988. Glimpses of coconut industry in India, Coconut Development Board, Cochin.
- Dendy DAY, Grimwood BE., 1973. Coconut Processing for the production of coconut oil and coconut protein food and feed products. Oleagineux, 28 (2)93-98.
- Kamaladevi, C.V.,1983. coconut research and development, wiley eastern limited, New Delhi
- Satyabalan k.,1995. Indian coconut j., 8: 89-90
- Bose, T.K., Mitra,Sk and Rathore (Eds). 1998. Fruita Tropical and subtropical, Naya Udhyag
- Chadha K.L. & Rethian p. (Eds) 1991. Advance Horticulture vol. IX-X. Plantation Crops and Spices Malhotra Publ;.House
- Kumar N.A., Khader p, Rangaswami and Irunppan I. 2000. Introductionb to spice ,plataion crops and Aromatic plants, Oxford and IBH
- TNAU Agriportal  
[http://agritech.tnau.ac.in/horticulture/horti\\_plantation%20crops\\_coconut.html](http://agritech.tnau.ac.in/horticulture/horti_plantation%20crops_coconut.html)
- Coconut research Institute Srilanka <http://www.cri.gov.lk/web/>
- Coconut Development Board India <http://coconutboard.nic.in/package.htm>
- Cargill Indonesia <http://www.cargill.com/connections/farming-in-indonesia/coconuts/index.jsp>