

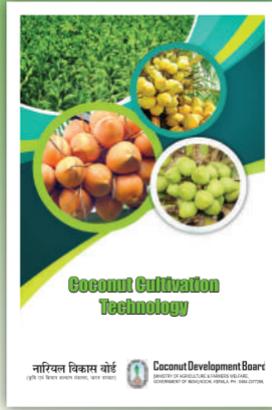


# Coconut Cultivation Technology

**नारियल विकास बोर्ड**  
(कृषि एवं किसान कल्याण मंत्रालय, भारत सरकार)



**Coconut Development Board**  
[MINISTRY OF AGRICULTURE & FARMERS WELFARE,  
GOVERNMENT OF INDIA] KOCHI, KERALA. PH : 0484-2377266, 67



Published by:

**Coconut Development Board**

Ministry of Agriculture and Farmer's Welfare

Editor :

Assistance :

Publisher:

Mini Mathew

Publicity Officer



### **Introduction:**

India is ranked as first largest producer of coconut in the world. The crop is grown in 2.08 million ha producing 23954 million nuts annually with productivity of 11505 nuts/ha. Four major Southern States viz., Kerala, Karnataka, Tamil Nadu and Andhra Pradesh together accounts for 90 per cent of coconut production. Kerala accounts for largest area (36.89 per cent of area) followed by Karnataka (25.20 per cent) and Tamil Nadu with (22.01 per cent).



### **Climate:**

It requires an equatorial climate with high humidity. The ideal mean annual temperature is 27°C with 5-7°C diurnal variation. All well distributed rainfall of 1300-2300 mm per annum is preferred.



### **Soil:**

Coconut is grown in different soil types such as laterite, coastal sandy, alluvial and also in reclaimed soils of the marshy lowlands. It tolerates salinity and a wide range of pH from 5.0 to 8.0. Proper drainage, good water holding capacity, optimum soil moisture and absence of rock or any hard substratum within 2 m of the surface are ideal for better growth and performance of the palm.

**Varieties of Coconut:**

**a. Dwarf Varieties --**

- Shorter in stature
- Life span is short as compared to the tall
- Height : 5-7 m
- Average life span : 40-50 years
- Bearing starts from 3-4 years after planting
- Nuts are smaller and the copra soft, leathery and low in oil content.
- Grown mainly for establishing parent material in hybrid seed production and for the tender coconuts.

Eg. Chowghat Orange Dwarf (COD), Chowghat Green Dwarf (CGD), Chowghat Yellow Dwarf (CYD), Malayan Green Dwarf (MGD), Malayan Orange Dwarf (MOD), Malayan Yellow Dwarf (MYD) and Ganga Bondam (GB).



*Chowghat Orange Dwarf  
(COD)*



*Chowghat Green Dwarf  
(CGD)*



*Malayan Green Dwarf  
(MGD)*



*Malayan Yellow Dwarf  
(MYD)*



*Malayan Orange Dwarf  
(MOD)*



*Ganga Bondam  
(GB)*



*West Coast Tall  
(WCT)*



*East Coast Tall  
(ECT)*



*Laccadive micro*

**b. Tall varieties –**

- Taller in stature
- Life span is longer as compared to dwarf
- Height : 15-18 m
- Average life span : 60-80 years
- Bearing starts from 7-10 years after planting
- Good quality copra, oil and fiber
- Cultivars named after the place where they are largely cultivated.

Eg : West Coast Tall (WCT), East Coast Tall (ECT), Laccadive Ordinary, Laccadive micro, Tiptur Tall, Kappadam, Komadan and Andaman Ordinary



*Kerasankara (WCT x COD)*



*Chandralaksha  
(LCT x COD)*



*Lakshaganga (LCT x GB)*





### c. Hybrids - •

- The intervarietal crosses of two morphological forms of coconut
- Earliness in flowering
- Increased yield, higher quantity and better quality of copra and oil when compared to the parents.
- Tall x Dwarf (TxD) : Tall - female mother palm & dwarf - male parent
- Dwarf x Tall (D x T) : Dwarf - female parent & tall - male parents .



*Chandrasankara*  
(COD x WCT)



*Kalpa Sankara*  
(CGD x WCT),



*Kalpa Samrudhi*  
(MYD x WCT),

## Production of quality seedlings in nursery

### a. Selection & preparation of site

- Well drained
- Light textured soil
- Not too much shade

### b. Selection of mother palms

- Regular bearing
- Yield not less than 80 nuts/annum
- Age – Dwarf - 5 years after reaching full bearing capacity,  
Tall-20 years or more
- More than 30 fully opened leaves
- Bearing 12 bunches of nuts
- Shape of crown : Spherical or semi-spherical
- Petioles : short and stout and be able to give effective support to the coconut bunches.
- Bunch stalks : short and strong and should not have the tendency of droop down.



**Avoid palms which have the following characteristics**

- Long, thin and pendulous inflorescence stalks
- Long, narrow, small sized or barren nuts
- Alternate bearing tendency.
- Immature nuts shedding in large numbers
- Grown under favorable environmental conditions.



**c. Selection of seednut**

- Nuts of medium size and oblong shape
- Age – above 11 month old
- Husked nuts more than 600 g weight
- Mean copra content 150g per nut or more

**d. Collection seed nuts**

- Time : Vary from region to region according to the seasonal conditions
- Ideal time - December to May
- Lowering of bunches by ropes



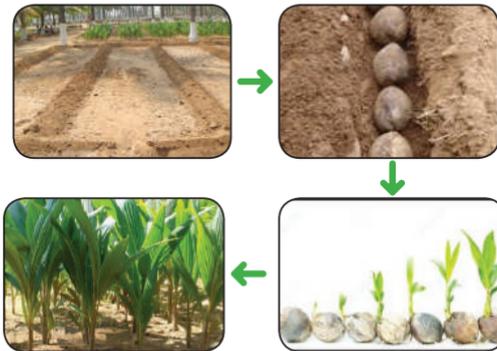


### e. Storage of seed nuts

- Do not sow immediately after harvest
- To get better quality seedlings, the seed nuts of tall and hybrid are to be air cured for one month followed by sand curing
- Store for 60 days till the husk becomes dry
- Storing - prepare 8cm sand layer – keep seednuts with stalk end up-cover with sand – keep upto five layers

### f. Bed preparation

- Width – 1.5 m
- Length – Convenient
- Space between beds – 75 cm
- Spacing Between rows – 30 cm
- Spacing between nuts – 30 cm
- No. of rows per bed – 4- 5
- Sow in trenches 25-30 cm deep
- Method of planting – two types Vertical and Horizontal
- Time of sowing – May-June



### g. Care and management of nursery

- Keep nursery beds free of weeds
- Irrigation – once in two days
- Termite attack – dust soil and nuts with Chlorpyrifos
- Fungal infection – Spray 1% Bordeaux mixture/copper fungicide



## Selection of good quality seedling

- 9-12 month old seedling
- At least four leaves for 9 month old seedling
- Six to eight leaves for 10-12 month old seedling
- Early germination, rapid growth & seedling vigour
- Collar girth : 10-12 cm
- Early splitting of leaves
- Remove seednuts do not germinate within 6 months after sowing
- Percentage of recovery : 60-65 per cent





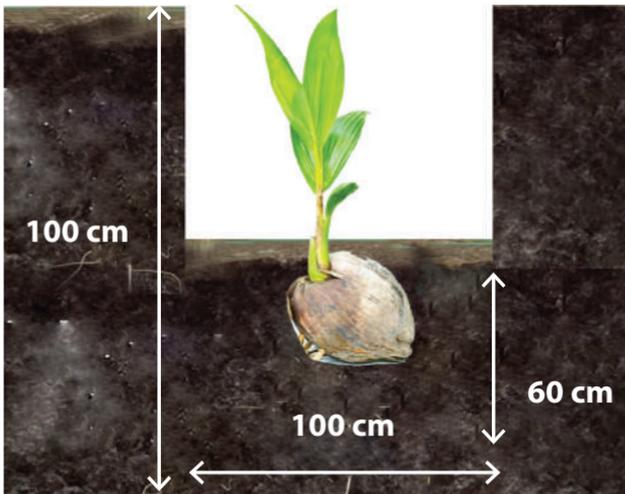
## Field preparation and planting

### **a. Planting Season:**

- Depends upon the local climatic condition
- Varies from State to State
- Proper time of planting : at the advent of the monsoon
- Under assured irrigation : planting at any time.
- In low lying areas : planting either after the monsoon or long before the monsoon.

### **b. Preparation of land and planting of seedlings**

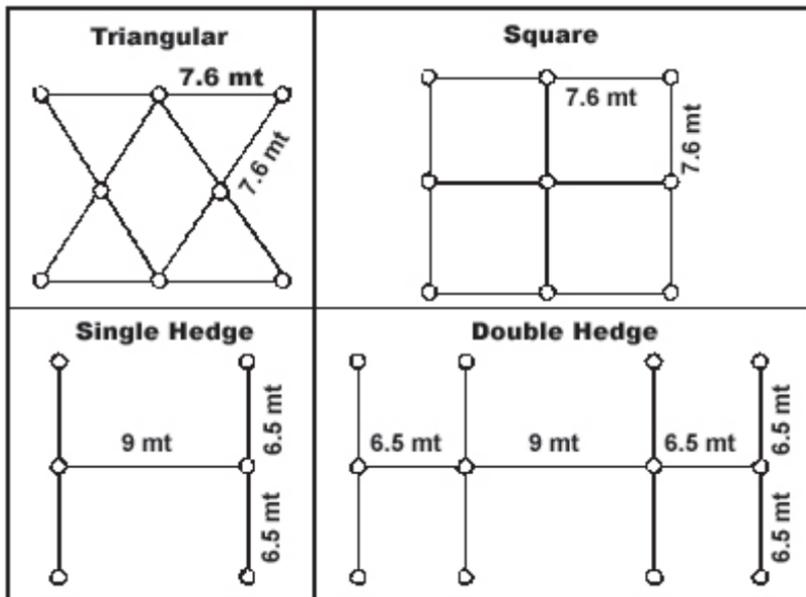
- Size of pit in loamy soil – 1m x 1m x 1m
- Size of pit in lateriate soils – 1.2 m x 1.2m x 1.2m
- Size of pit in sandy soil – 0.75m x 0.75m x 0.75 m
- Lateritic area – 2kg common salt per pit can be applied
- Fill pit to a height 60 cm with top soil
- Plant seedlings at the centre of the pit
- Ideal time of planting : May
- In low lying areas – plant seedlings in September



### c. Spacing:

A spacing of 7.5 x 7.5 m is generally recommended for Coconut. Spacing depends upon the planting system, soil type etc.

Planting system	Spacing	Approximate number of plants/ ha
Triangular	7.6 m	198
Square	7.6 m to 9 m	170-120
Single hedge	6.5 m in the rows 9 m between the rows	220
Double hedge	6.5m * 6.5 min rows 9m between pairs of rows	280





#### **d. Irrigation & Shading:**

- 45 litres of water once in 4 days has been found to be satisfactory in all soil types.
- Provide adequate shade to the transplanted seedlings

#### **e. Weeding and interculture:**

- Keep the pits free of weeds by periodical weeding
- Remove the soil covering the collar of seedlings.
- As the seedlings grow fill up the pits gradually by cutting the sides.

## Manuring and fertilizer



#### **a. Lime application**

- Apply lime or dolomite 1 kg/palm/year if soil is acidic
- Time- 15 days before fertilizer application

#### **b. Manuring and Fertilizer application**

- Regular manuring from the first year of planting is essential to achieve higher productivity.
- Organic manure: 20 - 50 kg per palm per year with the onset of south west monsoon, when soil moisture content is high. Different forms of organic manures like compost, farm yard manure, bone meal, fish meal, blood meal, neem cake, groundnut cake etc. could be made use for this purpose.
- Lime or dolomite – 1 Kg/palm/year
- Magnesium sulphate – 0.5 Kg/palm/year
- Fertilizer recommendation : 500:320:1200 g N,P<sub>2</sub>O<sub>5</sub>,K<sub>2</sub>O per palm per year



Time after planting	Split dose	Urea	Single super phosphate (16% P2O5)	Rock Phosphate (28%) (P2O5)	Muriate of Potash (60%) K2O
<b>General recommendation (A) Average Management</b>					
3 months	1/10 of full dose	75	95	60	115
1 year	1/3rd of full dose	250	320	200	380
2 year	2/3 <sup>rd</sup> of full dose	500	640	400	760
3- year	Full dose	750	1060	600	1140
<b>(B) Good management</b>					
3 months	1/10 of full dose	110	200	115	200
1 year	1/3 <sup>rd</sup> of full dose	360	670	380	670
2 year	2/3 <sup>rd</sup> of full dose	720	1330	760	1340
3- year	Full dose	1080	2000	1140	2000
<b>2. Hybrids and high yielding palms under irrigated areas</b>					
3 months	1/10 of full dose	220	280	180	335
1 year	1/3 <sup>rd</sup> of full dose	720	930	600	1110
2 year	2/3 <sup>rd</sup> of full dose	1450	1850	1200	2220
3- year	Full dose	2170	2780	1800	3330



### **c. Method of fertilizer application**

- Make circular basin at a radius of 1.8 - 2.0 m from the base of the palm and 25 cm deep
- Apply 1 Kg lime/dolomite prior to fertilizer application to neutralize soil pH.
- Apply organic manure – 10 kg/pit in the first three years & 15-25 kg after 3 years of planting
- Rainfed conditions – apply fertilizers in two split doses, 1/3rd at the time of early southwest monsoon showers in April-June and 2/3rd in September-October
- Irrigated conditions – apply fertilizers in three or four equal doses in April-May, August-September, December and February-March.

## Irrigation

- Irrigate palms during summer months
- 600 – 1600 litres of water/irrigation/palm in a basin of 1.8 m radius based on soil texture
- Drip irrigation in case of scarcity of water
- 3-4 drippers are given per palm in drip irrigation
- It saves water, energy, labour and increase plant growth and yield



## Drought management

### **i. Husk burial:**

- Burying of fresh or dried coconut husk around the palm
- Husk can be buried in circular trenches taken around the palm at a distance of 2m from the trunk
- Trenches may be of 0.5 m width and depth
- Husk can be buried in linear trenches taken 3 m away from the trunk between rows of palms





- Husks are to be placed in layers with concave surface facing upwards and covered with soil
- Beneficial effect last for about 5-7 years
- Instead of husk, coir pith can be buried @ 25 kg per palm per year

### **ii. Mulching**

- Mulch coconut basin with green/ dry leaves
- Mulching adds organic matter and reduces the soil temperature
- Application of lime solution on the trunk up to a height of 2-3 m at the start of the summer season,



### **iii. Green manure and cover crops**

- Sow green manure and cover crop seeds during April – May with the onset of pre-monsoon rains
- Sow cow pea seeds in the basins taken at a radius of 2 m from the base of the palm
- Uproot the entire plant when few plants start flowering
- Incorporate the uprooted plants into the soil during August-September
- Cover the basins with soil
- Green manure crops : Sunhemp, Kolinji, Hairy indigo, Kudzu
- Cover crops : Calapagonium muconoides, Mimosa invisa, Stylosanthes gracilis
- Sowing 100 g cow pea in basin provides 15-25 kg green manure and will provides 100-200 g Nitrogen



## **Intercropping & mixed cropping**

- Schedule inter/mixed crop based on canopy size, age and spacing of palms
- Palms in the age group of 8-25 years are not suitable
- Cereals : Rice, maize
- Legumes and pulses : Groundnut, horse gram, cowpea

- Tubers : Tapioca, sweet potato, yams, colocasia
- Spices and condiments : Ginger, turmeric, chilly, pepper, nutmeg, cinnamon, clove
- Fruit plants : Banana, pineapple, papaya
- Beverage crop : Cocoa
- Fodder grasses : Hybrid Napier, guinea grass

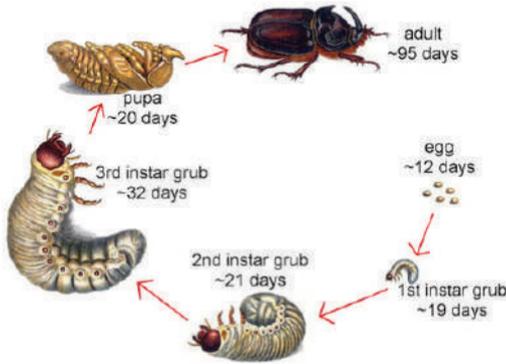
## Pests in coconut

### 1. Rhinoceros Beetle

#### **Symptoms:**

- Adult beetle bore into unopened fronds and spathes
- The attacked frond when fully opened shows characteristic triangular cuts
- Symptoms occurs throughout the year
- Main incidence June – Sep
- Hole in tender leaf spathe
- V shaped cutting on opened leaves
- The grubs of the beetle cause no harm to palms





**Life Cycle:**

- Female lay egg in organic manures
- 1 female lay 108 eggs mainly in June-July
- Grubs – 6 months
- Pupa in organic matter, 14-29 days
- Adult attack the palms

**Control**

- Field sanitation to prevent breeding of beetles
- Hook out the beetles from the attacked palms by using beetle hook
- Apply 250 g neem cake or marotti cake mixed with equal volume of sand in the innermost 2-3 leaf axils. Do twice – before onset of S-W monsoon and after the SW monsoon

in the innermost 2-3 leaf axils. Do twice – before onset of S-W monsoon and after the SW monsoon

→ Naphthalene balls 12 g (approx. 4 nos) in innermost 2 leaf axils at 45 days interval

→ Incorporate Clerodendron infortunatum in the cowdung or manure pits.

→ Release Baculovirus oryctes infected adults



@10-15/ha to bring down the pest population.

- Inoculate the breeding sites with entomopathogenic fungus *Metarrhizium anisopliae* (@ 5 x 10<sup>11</sup> spores/m<sup>3</sup>) causes mortality to the grubs
- Leaf axil filling with chlorantraniliprole (0.4WG) / chloridust @ 5g mixed with 250g of sand during April-May, and September –October
- Pheromone trap can be used in a continuous manner 1 trap/ Ha.

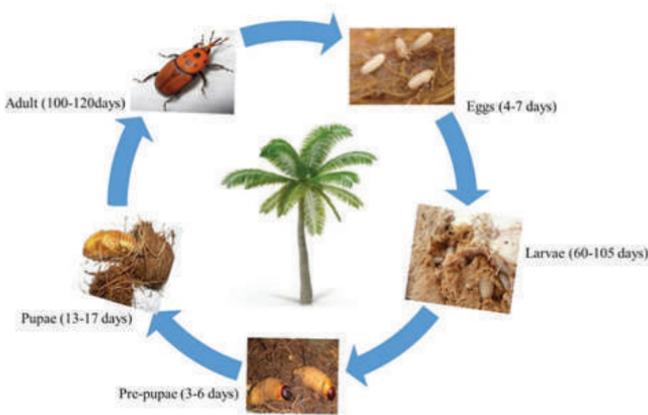
## 2. Red Palm Weevil (*Rhynchophorus ferrugineus*)

### Symptoms:

- Major pest of coconut
- Damage palms below 20 years

### Life Cycle:

- Female lay egg in organic manures
- 1 female lay 108 eggs mainly in June-July
- Egg hatches in 4-7 days
- Grubs inside tree trunks : 36 – 78 days
- Pupa in organic matter, 14-29 days
- Adult attack the palms





### Control Measures

→ Remove and burn all wilting or damaged palms in coconut gardens to prevent further perpetuation of the pest.

→ Avoid the cutting of green leaves. If needed, they should be cut about 120 cm away from the stem in order to prevent successful inward movement of the grubs through the cut end.

→ In attacked palms, observe for the bore- holes and seal them except the top most one. Through the top most hole, pour 0.02% Imidacloprid i.e. 1ml Imidacloprid in 1 litre water

→ When the pest infestation is through the crown, clean the crown and slowly pour the insecticidal suspension. In case of entry of weevil through the trunk, the hole in trunk may be plugged with cement / tar. A slanting hole is made with the aid of an auger and the insecticide solution is poured with funnel.

→ Fill the crown and the axils of top most three leaves with a mixture of fine sand and neem seed powder or neem seed kernel powder (2:1) once in three months to prevent the attack of rhinoceros beetle damage in which the red palm weevil lays eggs.



### 3. Coconut Eriophyid mite: *Aceria guerreronis*

#### Symptoms:

→ The mite infests and develops on the meristematic tissues under the perianth.

→ Initial symptoms exhibit as triangular pale white or yellow patches close to the perianth.

→ Continuous feeding results in necrosis of tissues leading to formation of brown color patches, longitudinal fissures and splits on the outer surface of the husk; oozing of brown gummy exudation; reduced nut size, copra content and malformation of nuts.

#### Life Cycle

→ Pale coloured, elongated, worm like mite is very minute in size measuring 200-250 micron length and 36-52 micron in width with two pairs of legs in the anterior end, head with piercing and sucking





mouth parts.

→ Life cycle consists of egg, two larval instars and an adult-stage and is completed in 10-12 days.

### **Control**

→ Apply 1% Azadirachtin ie 4 ml in 1 litre of water

→ Root feeding 5% Azadirachtin ie. Mix 7.5 ml Azadirachtin in 7.5 ml water in a polythene cover and rootfeed

→ Apply 2% Neem garlic emulsion ie. 20 ml neemoil, 20 g garlic, 5 g barsoap in 1 l water

→ Apply manures and fertilizers as per the recommended dose.

## Diseases of coconut

### BUD ROT

#### **Symptoms**

→ Palms of all age susceptible, but normally young palms are more susceptible, particularly during monsoon.

→ In seedlings, the earlier symptom is the yellowing of one or two younger leaves. Basal tissues of the leaf rots quickly and can be easily pulled out from the crown.

→ In the later stages the spindle withers and drops down.

→ The tender leaf base and soft tissues of the crown rot into a slimy mass of decayed material emitting foul smell.

→ Ultimately the entire crown falls down and the palm dies

→ In adult palms, the first visible symptom is the colour change of the spear, which becomes pale and breaks at the base and hangs down. The rotting slowly progresses downwards, finally affecting the meristem and killing the palms. This is accompanied

by drooping of successive leaves. Even then, nuts that are retained on the palm may grow to maturity

#### **Control measures**

→ Provide adequate drainage in gardens.

→ Adopt proper spacing and avoid over crowding in bud rot prone gardens.



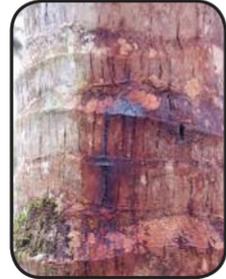


- Remove all the affected tissue of the crown region and drenching the crown with Copper oxychloride 0.25%. Apply Bordeaux paste and protect it from rain till normal shoot emerges. (Dissolve 100 gm of copper sulphate and 100 gm of quick lime each in 500ml. water separately and mix to form 1 litre of Bordeaux paste).
- Spray 0.25% Copper oxychloride or 1 % Bordeaux mixture on the crown of the neighbouring palms as a prophylactic measure before the onset of monsoon. Small, perforated sachets containing 2 g of mancozeb may be tied to the top of leaf axil. When it rains, a small quantity of the fungicide is released from the sachets to the leaf base, thus protecting the palm.
- The infected tissues from the crown region should be removed and dressed with Bordeaux paste sprayed with 1% Bordeaux mixture as pre-monsoon spray (May and September).
- Spray with Copper oxychloride 0.25% after the onset of Monsoon.

## 2. Stem bleeding disease: *Thielaviopsis paradoxa*

### Symptom:

- The progress of the disease is faster during July to November.
- Stem Bleeding is characterized by the exudation of a dark reddish brown liquid from the longitudinal cracks in the bark and wounds on the stem trickling down for a distance of several inches to several feet.
- The lesions spread upwards as the disease progresses.
- The liquid oozing out dries up and turns black. The tissues below the lesions become rotten and turn yellow first and later black.
- In advanced cases, the inner portions of affected trunks are hollow due to decay of inner tissues.
- As a result of extensive damage in the stem tissue, the outer whorl of the leaves turn yellow, dry and shed prematurely. The production of bunches is affected adversely. Nut fall is also noticed.



### Control measure

- Destroy the chiseled materials by burning. Avoid any mechanical injury to trunk.
- Along with 50kg FYM, apply 5kg neem cake containing the antagonistic fungi, *Trichoderma* @ 200g/palm/year culture to the basin during September.



- Provide adequate irrigation during summer and drainage during rainy season along with recommended fertilizer.
- Chisel out completely the affected tissues and paint the wound with Bordeaux paste. Apply coal tar after 1-2 days on the treated portion. Burn off chiseled pieces.

### 3. Root wilt (or) Kerala wilt disease:

#### *Phytoplasma*

#### **Symptom:**

- Tapering of terminal portion of the trunk.
- Reduction of leaf size
- Abnormal bending or Ribbing of leaf lets termed as flaccidity.
- Flowering is delayed and also yield is considerably reduced.
- The characteristic symptom is the flaccidity of leaflets. This is the earliest visual symptom. In the beginning yellowing is restricted from the leaf tips to the middle of the leaves, necrosis of leaflets and deterioration and decay of root system are other salient features of the disease. The leaflets curve inwardly to produce ribbing so that the whole frond develops a cup like appearance. Abnormal shedding of buttons and immature nuts are also noticed.



#### **Control measures**

- Cut and remove disease advanced, uneconomical palms yielding less than 10 nuts per palm per year
- Grow green manure crops - cowpea, sunhemp (*Crotalaria juncea*), *Mimosa invisa*, *Calapagonium mucanoides*, *Pueraria phaseoloides* etc. may be sown in coconut basins during April-May and incorporated during September-October.
- Irrigate coconut palms with at least 250 litre water in a week.
- Adopt suitable inter/mixed cropping in coconut gardens.
- Provide adequate drainage facilities.
- Apply recommended manures and fertilizers
- Magnesium may be supplied @ 500 g MgO per palm per year
- In addition to the above, apply 50 kg FYM or green manure and 5 kg of neem cake / palm / year.

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# Processing Technologies in Coconut sector

## Vision of CDB

*A fully developed and globally competitive coconut industry that contributes to food security, health and nutrition, remunerative price for the coconut farmer and enhanced export earnings for the country and to make India the global leader in value addition and processing in coconut sector.*

For promoting and attracting entrepreneurs in coconut processing sector, Coconut Development Board is providing entrepreneurship development and product oriented training at its technical wing "CDB Institute of Technology" (CIT). CIT offers various technical support services to Cooperatives / Farmer Producer Organizations / SHGs / Women groups, private entrepreneurs in setting up coconut based industries

## Programmes

- Technological research and development, training and process demonstration of value added coconut products
- Quality testing services for chemical and microbial analysis of coconut based products
- Processing of Neera and production of value added neera products
- Technology transfer for production of neera and value added neera products.
- Offers facility for project works to students of stream MSc, B.Sc, B.Tech and M.Tech in Food Technology/ Food Engineering/ Bio-technology, Chemistry and Microbiology in product development, quality assurance and for improving process efficiency.
- 14 days Neera master technician training programme for traditional tappers.



*Those who have undergone training can avail financial assistance of CDB under TMoC.*

## Technology Mission on Coconut (TMoC)

Financial assistance @ 25% of the project cost limited to 50 lakh for private entrepreneurs and 33.3% of the project cost limited to Rs. 50 lakh per project for SC/ST Women entrepreneurs for establishment of coconut processing units.

Contact number of CIT: 0484 2679680.

आवक: कसकसारे के नरुए कोडो को वेबसाइट परें : [www.coconutboard.nic.in](http://www.coconutboard.nic.in)

**नारियल विकास बोर्ड**

(कृषि एवं किसान कल्याण मंत्रालय, भारत सरकार)  
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For more details, visit Board's website: [www.coconutboard.nic.in](http://www.coconutboard.nic.in)

**Coconut Development Board**

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