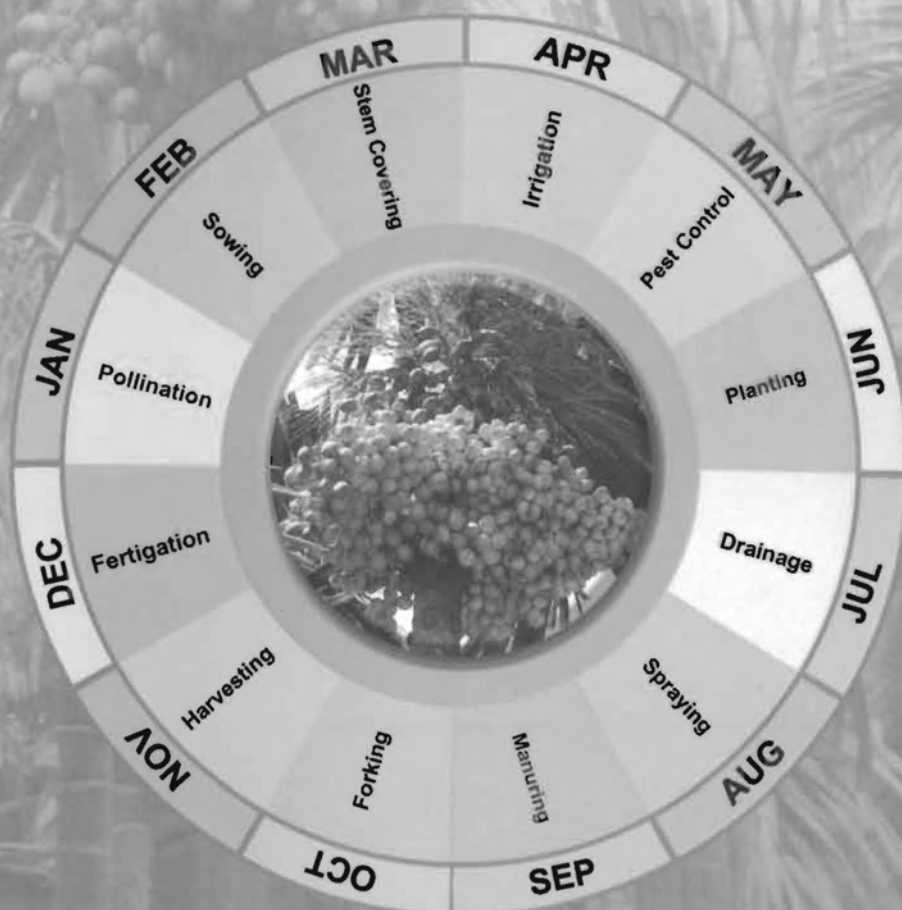


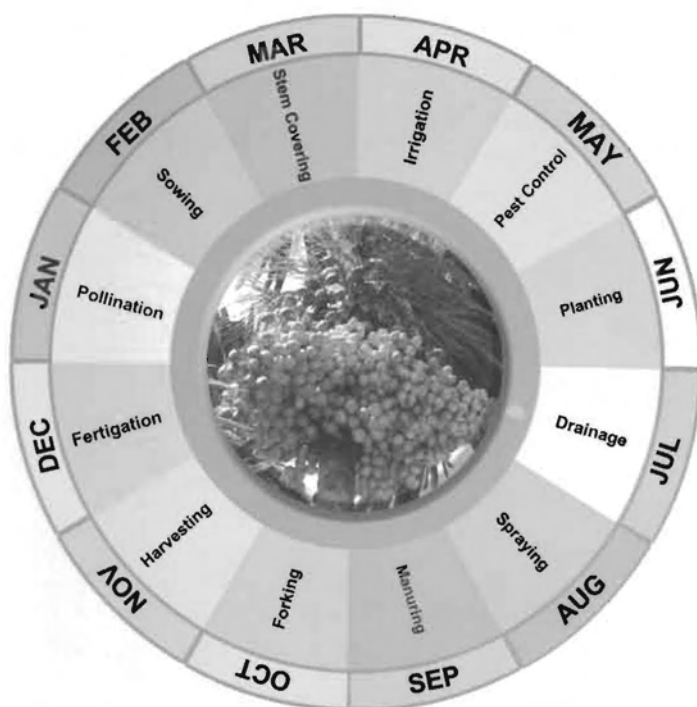
CALENDAR FOR ARECANUT



Central Plantation Crops Research Institute
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Kasaragod - 671124, Kerala, India



CALENDAR FOR ARECANUT



CENTRAL PLANTATION CROPS RESEARCH INSTITUTE

(Indian Council of Agricultural Research)

Regional Station, Vittal - 574 243, Karnataka

And

DIRECTORATE OF ARECANUT AND SPICES DEVELOPMENT

Ministry of Agriculture, Government of India,

Calicut - 673 005, Kerala

Technical bulletin No. 67

Calendar for Arecanut

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CALENDAR FOR ARECANUT

Arecanut (*Areca catechu* L.) is one of the important commercial crops grown in parts of Karnataka, Kerala, Assam, Meghalaya, West Bengal and Andaman and Nicobar Islands. The cultivation has also been extended to other states like Tamil Nadu, Andhra Pradesh and Maharashtra. In our country, Arecanut is being grown in an area of 3.96 lakh hectares with a production of 5.59 lakh tonnes in the year 2006-07. India is the largest producer and consumer of arecanut in the world holding 62% of the area and 60% of the production. The other major arecanut growing countries are Indonesia, Bangladesh, China, Myanmar and Thailand. Arecanut being a profitable plantation crop, it is important to understand the package of practices and seasonal operations to be followed in the nursery, in young gardens and in old plantations to get maximum returns. To get additional income in the adverse periods, concept of cropping system is very important which is also documented here for the benefit of farmers and extension officials.

Climatic requirements

Agroclimatic zone: Western Plains and Ghats as well as the North Eastern Hills. The cultivation of arecanut is mostly confined to 28° North and South of the equator.

Altitude: Arecanut can be cultivated upto an altitude of 1000 m from mean sea level.

Temperature: Arecanut grows in a wide range of temperature between a minimum of 4°C and a maximum of 40°C. However, the palm flourishes well within a temperature range of 14°C to 36°C.

Rainfall: Arecanut requires abundant and well distributed rainfall. It grows well in tracts, where annual showers may go upto or even more than 4500 mm. But it also survives in low rainfall areas having 750 mm annual precipitation. During prolonged dry spell palms should be irrigated.

Soil

Arecanut cultivation was predominant in gravelly laterite soils of red clay type of Southern Kerala and Coastal Karnataka. Laterite, red loam and alluvial soils are most suitable. In plain region or maidan part of Karnataka, it is cultivated in fertile clay loam soils. In areas, where tank irrigation is common practice, the soils may have admixture of tank silt. Soil pH range from 5.2 to 7.0 is suitable for cultivation.

Varieties

Systematic evaluation of exotic and indigenous accessions of Arecanut through selection and hybridization at CPCRI, Regional Station, Vittal, Karnataka resulted in release of varieties with high yield and desirable characteristics. The varieties will perform and show their potential if grown with good management conditions and recommended practices.

Cultivars and varieties with desirable characteristics

Characteristics	Cultivars/ Varieties
High yielding	CPCRI varieties, Calicut-17, Sirsi Areca Selection (SAS)-1
Early bearing	Mangala
More number of fruits	Thirthahalli, Devadarshini
Better nut quality	Shriwardhan, Sweet areca
Large fruit size	South Kanara Local, Kahikuchi, Calicut-17, Sreemangala
Regular bearing	South Kanara Local
Semi- tall	Mangala, Swarnamangala, Shriwardhan
Dwarfness	Hirehalli Dwarf, VTLAH-1 and VTLAH-2
Uniformity	Mohitnagar
Tender nut	Thirthahalli, Shriwardhan, Hirehalli Tall

Arecanut growing areas with suitable varieties

Areas	Varieties
All areca growing areas	CPCRI varieties
North Kerala, South Karnataka	Kasaragod Local, South Kanara Local
Malnad areas of Karnataka	Thirthahalli
Shimoga and Uttara Kannada	Sagar
Coastal Maharashtra and Karnataka	Shriwardhan
Maidan Parts of Karnataka (Tumkur, Mandya, Hassan, Bangalore)	Hirehalli Tall
Tamil Nadu	Mohitnagar, Mettupalayam Local
West Bengal, Assam	Mohitnagar, Kahikuchi Tall
Andaman and Nicobar Islands	Calicut-17



• Areca growing states

Varieties released by CPCRI



MANGALA

Selection from China
Year of release: 1972
For coastal Karnataka and Kerala
Semi tall, early and heavy bearer
Leaflets have crinkling at the tip
Medium sized round nuts
Average yield (chali/palm): 3.00 kg



SUMANGALA

Selection from Indonesia
Year of release: 1985
For Karnataka and Kerala
Tall, heavy bearer
Flowering in 4-5 years
Oval to round medium nuts
Average yield (chali/palm): 3.28 kg



SREEMANGALA

Selection from Singapore
Year of release: 1985
For Karnataka and Kerala
Tall, long internodes
Flowering in 4-5 years
Round, oval, deep yellow nuts
Average yield (chali/palm): 3.18 kg



MOHITNAGAR

Indigenous to West Bengal
Year of release: 1991
For West Bengal, Karnataka & Kerala
Tall, sturdy stem, uniform nuts
Flowering in 4-5 years
Oval, medium, deep yellow nuts
Average yield (chali/palm): 3.67 kg



SWARNAMANGALA

Selection from Saigon

Year of release: 2006

For Karnataka and Kerala

Semi-tall, regular bearer

Flowering in 4 years

Oblong, bold, orange nuts

Average yield (chali/palm): 3.78 kg



KAHIKUCHI TALL

Indigenous to Assam

Year of release: 2010

For Assam and North East Hills

Tall, shorter internodes

Flowering in 4-5 years

Round, big, orange nuts

Average yield (chali/palm): 3.70 kg



VTLAH-1

Vittal Areca Hybrid- 1

Hirehalli Dwarf x Sumangala

Year of release: 2006

For Karnataka and Kerala

Dwarf, reduced canopy

Early yield stabilisation

Oval, medium, orange nuts

Average yield (chali/palm): 2.55 kg



VTLAH-2

Vittal Areca Hybrid- 2

Hirehalli Dwarf x Mohitnagar

Year of release: 2006

For Karnataka and Kerala

Dwarf, reduced canopy

Early yield stabilisation

Oval, medium, orange nuts

Average yield (chali/palm): 2.64 kg

Quality planting material production

Arecanut is propagated by seeds. Being a perennial and cross pollinated crop, adequate care should be taken in selecting the planting material. Seed nuts of three different types are preferred for seedling production.

Open pollinated: Seed nuts harvested from selected mother palms of the desired cultivar/variety without any artificial emasculation (removal of male flowers) and pollination.

Inter se: Seed nuts produced after emasculation and pollination by using the pollen of selected palms of the same cultivar/variety.

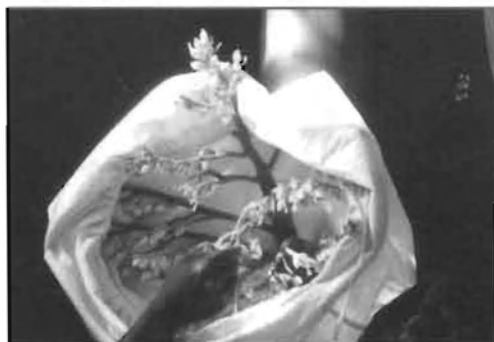
Hybrid: Seed nuts produced after emasculation and pollination between two different desired parents.

Crossing technique:

In Arecanut, the hybridization technique consists of removing the portion of rachillae having male flowers (emasculation) soon after emergence of the inflorescence and covering the spadix bearing female flowers with a cloth bag. When the female flowers open, the anther from the desired male parent is rubbed against the stigma or the pollen is dusted on the stigmatic surface, by removing the bag. The bag is replaced over the inflorescence immediately after pollination. The process is repeated daily for about a week till all the female flowers in the spadix open and fruit set can be seen after 20 days. In artificial pollination, fully opened male flowers are collected from the selected palms and are transferred to a reagent bottle containing 0.5 per cent solution of sucrose and the bottle is shaken gently. The pollen grains thereupon get released in the aqueous solution. The solution with the pollen grain in suspension is transferred to an ordinary hand atomizer and sprayed onto newly opened female flowers. The spraying may have to be done three to four times, as all the female flowers do not open at the same time. About 14 per cent increase in fruit set was obtained by this method and the same could be successfully used in commercial hybridization.



Emasculation



Pollination

Mother palm selection:

- Mother palms should be more than 12 years old.
- Palm should be a regular bearer.
- Early bearing nature (36-40 months after planting).
- Partially drooping or drooping crown.
- More number of leaves (>10) and shorter internodes.
- High fruit set (>55% set) around 350-400 fresh nuts/palm/year.
- Consistent yield of about 3 kg or more dry kernel (chali)/palm/year.
- High recovery of chali from fresh fruit (>25%).
- Elite palms should be free from diseases and pests incidence.
- Mother palms should be selected based on the requirements for processing, chali or tender nuts.

Selection of seed nut:

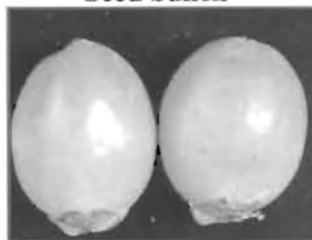
- Fully ripe heavy nuts weighing more than 35 gram will give better germination (96%) than lighter nuts and give more number of quality seedlings. The mature nuts should be harvested when at least few nuts in the oldest bunch starts falling. Normally it takes 11-12 months to become a mature seed nut after pollination.
- Rope harvest of seed nuts is recommended from the trees which are very tall and in places where the ground is hard.
- The nuts, which float vertically with calyx end pointing upwards in water will produce more vigorous seedlings.
- Harvested seed nuts can be stored only for about 3 to 6 days since the nuts are recalcitrant, i.e., viability will be lost soon.



Mother palm



Seed bunch



Seed nut

Primary nursery:

Sowing the nuts immediately after harvest in soil/sand and watering once in two days will result in early and good germination. Selected seed nuts are sown with their stalk end pointing upwards, 5 cm apart in sand beds of 1.5 m width and convenient length. Thick mulching is to be done with straw/areca leaves. Beds are to be watered daily either by using hose or micro-sprinklers. Germination of nuts usually commences by 45 days and completed by 95 days.

Secondary nursery:

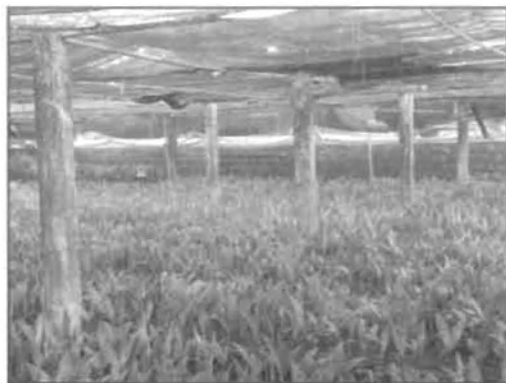
For raising the seedlings in secondary nursery, beds of about 150 cm width and 15 cm height are suggested. A spacing of 30-45 cm is considered optimum for planting three months old sprouts in secondary nursery and repotting in poly bags is also preferred. The secondary nursery should be given a basal dose of decomposed farmyard manure or vermicompost @ 5 tonnes per ha. The nursery should be partially shaded to get good seedlings.

Polybag nursery:

- Seed nuts may be sown directly in poly bags of 6"x9" size and 250 gauge thickness, with holes for drainage.
- Potting mixture should be of Soil: FYM: Sand in the ratio 7: 3: 2. Well decomposed farm yard manure or vermicompost and sieved sand should be used for potting mixture preparation.
- Solarization of soil by covering with black polythene sheet and sun drying of potting mixture for one week may be practiced to avoid any soil borne diseases.
- Daily watering during rainless period is needed to ensure desired growth.



Sowing in nursery bed



Poly bag nursery

Selection of seedlings:

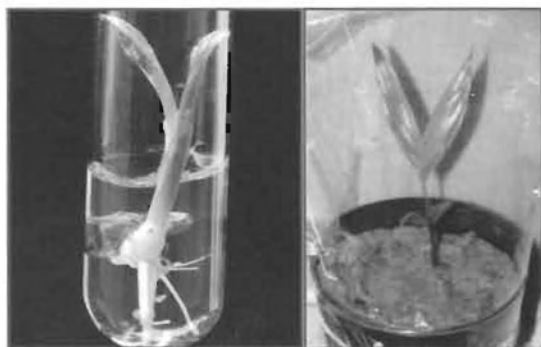
- Seedlings of 1-1.5 years of age having six or more leaves (early leaf splitting), 90 cm height and 26 cm collar girth should be selected. Seedlings having more than 5 nodes after two years are the best seedlings to get better yield.
- The seedling should have well established root system with 5-8 main fibrous roots intact and active while transplanting.
- The seedlings have to be uprooted with a ball of earth adhering to roots if, they are raised in nursery bed.
- Poly bag seedlings are preferred for long distance transport.
- Care should be taken to prevent damage/breakage of seedlings at the collar region during transportation.
- Seedlings should be free from leaf blight, leaf spot and collar rot.

Nursery requirement:

An area of 4,000 square meters is required to maintain 50,000 seedlings. Areca sprouts and seedlings are very delicate and do not withstand exposure to direct sunlight. Hence, proper shade should be provided to the nursery. The shade may be either of coconut or arecanut leaves spread over a pandal or by covering with 50-75% shade net (green or black) or by planting some fast growing green manures or banana around nursery. The nursery should be watered regularly during summer and proper drainage should be provided during rainy season. Periodical weeding and mulching is required. Nursery can be raised in the interspaces of coconut plantation and also in widely spaced arecanut gardens. Sprinkler/micro-jet/hose irrigation systems are well suited to arecanut nursery beds/polybag seedlings.

Tissue cultured Arecanut:

Multiplication by tissue culture from inflorescence has been standardized by CPCRI for producing large number of plantlets of proven, elite, high yielding, disease free and dwarf palms.



Tissue cultured areca in tube and pot



Tissue cultured areca in field

Garden establishment

Selection of site and layout:

Arecanut thrives well in humid areas protected well against hot sunburn and heavy wind. Aligning the rows in north-south direction with a deviation of 35° towards south-west lowers the incidence of sun scorch. Since the areca palm does not withstand either water logging or drought, the site selected should have adequate facility of water for irrigation and the soil should have proper drainage facilities. The soil depth and the depth of water table are other two parameters to be considered while selecting the site. The soil should be deep (preferably not less than two meters) and water table should be sufficiently low for better root development. Water logged condition favours root rotting and production of aerial roots.

Spacing:

A spacing of 2.7 m x 2.7 m is recommended for arecanut planting. When arecanut is planted as a mixed crop with other crops, wider spacing of 3.3 m x 3.3 m will be optimum. Dwarf areca cultivar and hybrids may be grown in 2.2 m x 2.2 m spacing.

Depth of planting:

Depth of planting is mainly decided by the soil type and the height of water. In laterite soil with good drainage, the seedlings are planted at 90 cm depth to get vigorous, early bearing and high yielding palms. But in heavier soils of Hirehalli and soils with higher water table at Kahikuchi (Assam) 60 cm will be good.

Season of planting:

In areas where south-west monsoon is severe, planting in the month of September-October is recommended. In other areas planting can be done in the months of May-June. Mulching should be done immediately after planting, before end of monsoon, to avoid drying up of top soil.

Drainage:

For better growth and development of the plants, proper drainage is essential. The number of drainage channel depends upon the soil type. In light soils the number of channels may be less and in heavy soils the channels should be dug in each row and borders around the plot for proper draining of the excess water. The channels should be at least 25-30 cm deeper than the depth at which the seedlings are planted.



Planting



Mulching

Arecanut based cropping systems

The long pre-bearing period, low returns during the initial bearing stage, fluctuations in market prices, unexpected loss due to pests and diseases and natural calamities are some of the problems associated with arecanut cultivation. Approximately 60 per cent of the light is intercepted by an adult areca palm and 65 percent of space in areca garden is not effectively utilized. To overcome these problems and to utilize the available resources farmers started growing crops like banana, betelvine, pepper, tapioca, colocasia, dioscorea, pineapple and jack to realise some income during juvenile phase of arecanut. This practice of growing crops along with the arecanut palms is called inter/mixed cropping. These systems along with high density multi species cropping, increases productivity per unit area and maximize the economic returns. There was perceptible increase in arecanut yield (7-21 per cent) with intercropping, as they are responsible for creation of favourable microclimate and recycling of large quantities of organic matter, resulting in improved soil fertility.

Intercropping:

It is a system where annual or biennial crops are grown with arecanut. Crops like paddy, sorghum, cowpea, vegetables and yams can be grown. For these crops, agro techniques should be followed as per sole crop recommendation. Leaving 1.0 m radius around arecanut palm, interspaces are prepared for cultivation of intercrops during the pre-monsoon period. Crops like paddy, sorghum, corn, cowpea are sown in rows and groundnut and sweet potato are sown in furrows. Pits or trenches are taken for dioscorea, elephant foot yam, banana and pineapple. Crops like ginger, turmeric, arrowroot, chillies etc. are planted in raised beds of convenient size. Intercrops don't have any deleterious effect on arecanut. Crop selection should be done according to local preference and market. Banana is a popular intercrop and gives income during early years of planting of arecanut and throughout the growth period as well.

Of late, medicinal and aromatic plants are looked upon as a source of income. With procurement facilities like buy back schemes, the potential returns are quite high. Medicinal plants like Shatavari (*Asparagus racemosus*), Vetiver (*Vetiver zizanoides*), Long pepper (*Piper longum*), Brahmi (*Bacopa monnieri*), Nilagirianthus ciliatus, Periwinkle (*Catharanthus roseus*), Aloe (*Aloe vera*), Aswagandha (*Withania somnifera*) and aromatic plants like Lemon grass (*Cymbopogon flexuosus*), Palmarosa (*Cymbopogon martinii*), Basil (*Ocimum basilicum*), Davana (*Artemisia pallens*) and Patchouli (*Pogostemon cablin*) are suitable for intercropping in arecanut.

Mixed cropping systems:

Growing of perennial crops as associated crops in arecanut garden is mixed cropping system. Several combination of crops were tried and beneficial ones are listed below.

Black Pepper

Black pepper is an excellent crop for mixed cropping. Arecanut stems are used as live standards for training black pepper, when palms attain the age of 6-8 years. Two rooted pepper cuttings

are planted on the northern side of the palm dug at a distance of 75 cm. Pepper begins to yield in third year and comes to full bearing by seventh or eighth year. On an average, one kg dry pepper can be obtained from each vine.

Banana

Three to four month old disease free suckers are planted in the centre of four areca palms. Besides the main crop, two ratoon crops can be harvested in three year period and after three years, entire crop is to be replanted. Banana can yield as much as 10 t/ha when intercropped with arecanut.

Cocoa

Cocoa proved as a successful mixed crop under arecanut. It is being grown extensively in the recent years because of its demand in chocolate industry. Cocoa grafts are planted in alternate rows to give a spacing 2.7 m x 5.4 m. Cocoa has to be pruned in August-September and shaped to get a canopy at a height of 1.5 to 2.0 m. Cocoa flowers from second year onwards and bears round the year, with two peaks during June and December. On an average, 20 kg pods per tree are produced in a year which gives about 2 kg dry beans per year per tree.

Cardamom

Cardamom is raised as a mixed crop with arecanut, especially at higher elevations upto 700 m. In Uttar Kannada district of Karnataka and Wynad district of Kerala, the cultivation of cardamom as a mixed crop with arecanut is a common practice. After seven years of planting arecanut, cardamom seedlings have to be planted between two arecanut palms. About 1250-1500 plants are accommodated in a hectare of areca garden. The input and drainage requirements of arecanut and cardamom are same. Few gardens of Chikmagalur has coffee as one of the component crops.

High Density Multispecies Cropping System:

It is a system where more than two crops are grown simultaneously with arecanut. The choice of component crops mainly depends upon its ability to grow under the shade of arecanut palm, to withstand high rainfall, proper choice of varieties, planting geometry, fertilizers and irrigation management. Arecanut + Cocoa + Banana + Black pepper are the widely adopted system. Efficient cropping systems models for different agro-climatic regions have been identified.

Mixed farming systems:

With arecanut garden if dairy, poultry, pisciculture (fishes) and apiculture units are integrated it is called mixed farming. Raising fodder grass like hybrid napier or guinea grass in one hectare of arecanut garden can support 4 to 5 dairy animals.

Efficient cropping models for different regions

Sl. No.	Region	Cropping Model
1	Maidan parts of Karnataka	Arecanut+Black pepper+Cocoa
2	Maidan parts of Karnataka	Arecanut+Banana+Acid lime
3	Coastal Karnataka and Kerala	Arecanut+ Black pepper+Cocoa+Banana
4	North Bengal	Arecanut+ Black pepper+Banana or Arecanut+Black pepper+Acid lime
5	Wynad of Kerala and Uttara Kannada of Karnataka	Arecanut+Cardamom Arecanut+ Coffee

Crop	Pit size (cm)	Spacing (m)	Fertilizer N:P:K (g/plant)	Suitable varieties
Banana	50x50x50	2.7x5.4	160:160:320	Mysore, Poovan, Karpuravally, Robusta
Black pepper	50x50x50	2.7x2.7	100:40:140	Karimunda, Panniyur-1, 5
Cocoa	50x50x50	2.7x5.4	100:40:140	Grafts, F1 hybrids
Acid lime	50x50x50	2.7x5.4	300:250:500	-
Betelvine	50x50x50	2.7x2.7	100:40:140	-

Cropping systems



Areca with Cocoa



High Density Multispecies System



Areca + Banana



Areca + Black pepper



Areca + Lemon grass



Areca + Periwinkle



Areca + Turmeric



Areca + Coffee



Mixed farming



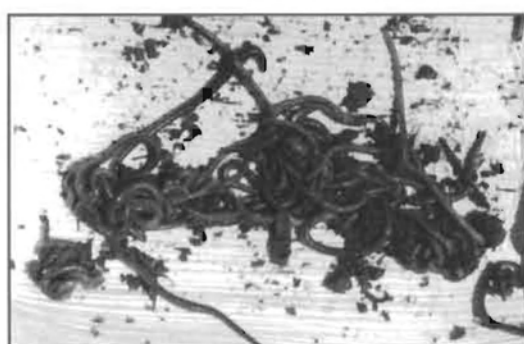
Fodder grass

Biomass recycling/ Vermicomposting

On an average 5.5-6 tonnes of organic wastes (recyclable biomass)/ha/year will be available in arecanut garden. Direct recycling of these wastes does not meet the crop demand immediately. Vermiculture technique is proved to be an efficient method of composting. To prepare vermicompost, chop the areca wastes into small pieces of 5-10 cm. Fill them in cement tanks alternately with layers of cow dung @ 10% by weight of waste materials. Maintain moisture content of about 30-40%. Incubate for 2-3 weeks and introduce worms @ 1 kg per 1000 kg waste. The wastes will be converted into fine granular, odourless vermicompost within 60 days. During this period the earthworm population will also be doubled. About 8 kg/palm/year of vermicompost meets the crop nutrient demand. The two cultured species of earthworm *Eudrilus eugeniae* and *Eisenia foetida* can be used.



Vermicomposting



Earthworms

CALENDAR OF OPERATIONS FOR ARECANUT

JANUARY

Nursery

- Watering daily through hose/sprinkler irrigation/fine misting
- Weeding
- Removal of weak seedlings
- Based on the availability of seed nuts, re-sowing can be done in ungerminated bags in nurseries, which are in operation throughout the year with water facilities
- Repotting of 3 months old sprouts from primary nursery into poly bags
- Overhead shade maintenance with shade net/thatched areca leaves/plaited coconut fronds

New garden

- Shading and irrigation

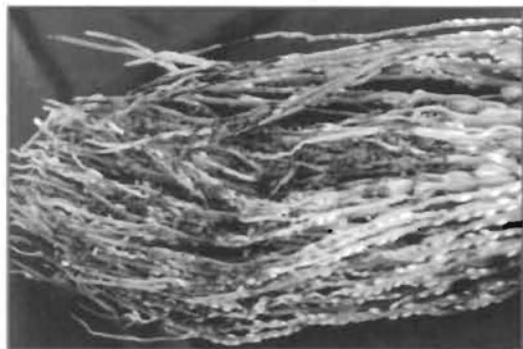
Old garden

- Harvesting and drying of ripe nuts may be continued
- Hose irrigation may be given once in 4 to 7 days at the rate of 175 litres of water per application. 20 litres of water/palm/day may be applied through drip irrigation system
- Control for mite and inflorescence caterpillar may be taken up

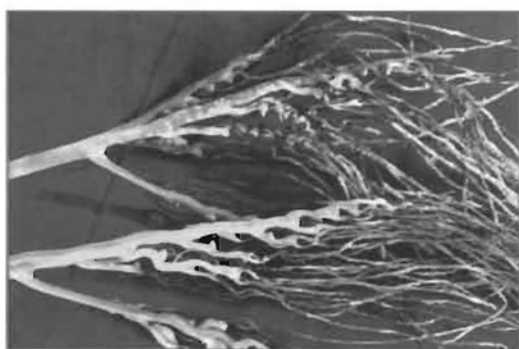
Inflorescence caterpillar (*Tirathaba mundella* Walker)

Symptoms: This causes damage to areca inflorescence, tender rachillae and female flowers. Mechanical injury is a pre disposing factor for infestation. Delayed opening of spadices is an indication of attack by inflorescence caterpillar.

Control: Open the spadices and spray Malathion 50 EC (250 ml in 100 l of water) if pest is noticed. If the female flowers are damaged, the inflorescence should be removed and burnt. If damage is partial, remove affected portion. Control slugs, which predispose inflorescence to the attack of caterpillar, by using bait of Metaldehyde.



Inflorescence caterpillar



Inflorescence die back

FEBRUARY

Nursery

- Daily watering
- Weekly weeding
- Rearranging bags
- Shade maintenance

Young garden

- Hose irrigation may be given once in five days
- Drip irrigation on daily basis @ 20 litres/palm/day
- If the existing plaited coconut frond provided as shade to young seedlings decomposed or damaged, replace with new one
- After weeding the cut weeds and palm leaves can be spread over the barren soil in between rows, which will act as mulching material and enrich the organic content of the soil
- Measures such as contour bunding, terracing etc. can be taken up in sloppy lands for soil and moisture conservation

Old garden

- South west side of arecanut garden may be protected from sun scorch by wrapping the green portions of the stem with dry areca leaves, leaf sheaths or opaque polythene film or painting with lime
- Irrigate during the dry spell in west coast once in six days. For efficient water use, drip irrigation can be followed
- Application of organic mulches, green/dried forest leaves, areca husk etc to the base of the palm helps in conservation of soil moisture, loosening heavy soils, increasing aeration and water intake
- Inflorescence die back may be noticed and controlled

Inflorescence dieback (*Colletotrichum gloeosporioides*) and button shedding

Symptoms: This disease is seen throughout the year but, becomes severe during February to May. Yellowing progresses from the tip of the rachillae towards the main rachis and as this spreads downwards it turn dark brown followed by drying, a condition known as die back. Subsequent spread of yellowing and discoloration induces shedding of female flowers.

Control: Spray with Indofil M45 @ 3g/l of water or Dithane Z78 @ 4g/l of water on opening of female flowers in most of the inflorescences. Second spraying may be taken up after an interval of 20-25 days. Remove and destroy infected dried bunches with fungal growth to reduce inoculum level in the garden.

MARCH

Nursery

- Daily watering
- Regular supervision of shade net position
- Tie the nets tightly without bending over the permanent pipes and pillars in the nursery
- Cover the entire nursery area to allow filtered sunlight

Young garden

- Mulching with green leaves/coir compost/5 kg FYM will conserve the moisture in the young garden during summer and enrich the physical properties of the soil. Chopped areca leaves, cut grass, arecanut husk, fresh and dry leaves collected from the forests can also be used as mulch in areca gardens
- Hose irrigation once in five days or daily by drip irrigation
- Shade management with intercropped banana and other shade trees in the borders to reduce the effect of sun. *Casuarina* and *Gliricidia* are also being grown in borders for shade and as wind breaks

Old garden

- Irrigation may be continued wherever facilities exist
- Severe sun scorching and stem breaking may be noticed and control measures may be taken up
- Arecanut palms particularly those under exposed conditions, may show symptoms of mite attack
- Generally, attack of pests will be more during summer months and so surveillance is very important

Sun scorching

Symptoms: The constant exposure of the stem to solar radiation causes this scorching. Golden yellow patches appear on the exposed portions of the stem, fissures develop later. Further, colonization by saprophytic organisms and insects cause decay of the stem and such palms break during heavy wind which, results in loss of both produce and the palm.

Control: Adoption of proper alignment in the north south direction while planting will greatly minimize the damage due to sun scorch. Young palms are more prone to scorching. Raising rapidly growing shade trees on the south-western side of the garden will reduce the sun scorching. Growing banana as a shade tree in young gardens and trailing pepper vines on palms will reduce the radiation effect. Covering the trunk with areca leaf sheath and painting with lime are being practiced in few gardens. Palms with longitudinal fissures are to be reinforced with split areca stem.



Hose irrigation



Overhead sprinkler



Fissures due to sun scorch



Stem covering with areca leaves



Broken scorched stem



Painting stem with lime

Nursery

- Daily watering
- Control leaf spot disease

Young garden

- Weeding

Old garden

- Forking and application of first dose of fertilizers at the end of April in the irrigated garden
- Irrigate sufficiently after fertilizer application for efficient absorption
- Control mites, pentatomid bugs and scale insects

Fertilizer schedule

An annual application of 100 g N, 40 g P_2O_5 and 140 g K_2O per tree in two equal splits is recommended along with 12 kg green leaf, compost or FYM. 5 kg vermicompost may be sufficient to supply 100% nitrogen. For seedlings, 1/3rd of the recommended dose of chemical fertilizers is sufficient during the first year, 2/3rd during the second year and full dose from third year onwards. The fertilizer is applied in two splits, the first dose in April-May and the second dose in September-October i.e. pre and post monsoon applications.

Fertilizer (g/palm)	I year	II year	III year onwards
Nitrogen	33	66	100
Phosphorous	13	26	40
Potash	46	92	140
Urea	72	144	220
Rock Phosphate	65	130	200
Muriate of Potash	77	154	230

Method of application:

Fertilizer may be applied uniformly around the base of the tree upto a radius of 30 cm during the first year, forked and incorporated into the soil. For grown up plants the best method is to rake and mix the fertilizers with soil in shallow basins of around 75 cm. This radius may be increased gradually upto 150 cm after third year.



Raking the basin



Fertilizer application

Fertigation:

The application of nutrients through irrigation water is called as fertigation. This technology can be profitably adopted in arecanut, which can save fertilizer upto 25% and also reduces cost of production by about 50%.

Criteria for applying fertilizers through drip

- > The fertilizers used should avoid corrosion of the system
- > The fertilizers should be soluble in water
- > The fertilizers should not react with salts or other chemicals in irrigation water which may lead to clogging of the emitters

Fertigation methods

The fertilizers can be injected into the system by different methods. Important techniques are using the main pump, using a separate small pump or by using a fertilizer tank placed above the main irrigation tank. These techniques can be used when area is large. When area is small, vacuum injection (venturi) technique can be followed.

Sources of nutrients

- > Nitrogen fertilizers: Urea
- > Phosphatic fertilizers: Di-Ammonium Phosphate (DAP)
- > Potassic fertilizers: Muriate of Potash (MoP)

Fertigation time and frequency

Fertilizers should be applied during the summer irrigations from December to May. The fertilizers can be applied once in 10 or 20 days. The application of fertilizer should be avoided during monsoon season. The total quantity of fertilizer to be given is to be split into 9 or 18 parts and each part will be applied once in 20 or 10 days respectively. For pre-bearing palms, 50% of recommended fertilizer is sufficient when supplied through drip irrigation. For bearing palms, 75% of the recommended fertilizer is sufficient.



Fertigation unit



Drip line in plot

Mites (Red and White) (*Raoiella indica* Hirst. and *Oligonychus indicus* Hirst.)

Symptoms: Mites feed on lower surface of arecanut leaves. The colony is found under white webs. Leaf shows yellow speckles and bronzed appearance. In seedlings mite infestation in all leaves causes yellowing and death, in older palms it starts in the lower whorl and it spreads to the inner whorl of leaves. Mites may also attack bunches resulting in tender nut fall. The gardens under drought stress and nurseries are more prone to mite infestation. Attack becomes severe during April-May.

Control: Heavily infested and dried leaves are to be cut and burn to check the spread of mites. Spray Kelthane (Dicofol) 2ml/l or Dimethoate (Rogor 30 EC) at 1.5 ml/l of water to the under surface of infested leaves. Repeat spraying at 15-20 days interval if there is recurrence of pest. Many *Coleopteran Coccinellids* are predators against mites.

Pentatomid bug (*Halyomorpha marmoreal* F.) or Tender nut drop

Symptoms: It generally occurs during April-July in some parts of Kerala and Karnataka and the first incidence will be in March. Premature drop of the nuts and pin-prick like black puncture marks on the shed nuts are the symptoms.

Control: Spray Dimethoate 0.05% (15 ml in 10 l of water) to the tender bunches and repeat it after 45 days if it is severe.

Scale insect (*Aonidiella orientalis* and *Ischnaapsis longinostris*)

Symptoms: The scale insects are seen feeding on nuts, rachillae and leaves. The damage is done by sucking the sap from the plant tissues. As a result of continuous sucking, the tissues become yellow in colour and severe feeding leads to withering and shedding of buttons/fruits. Damage is very heavy during drought conditions.

Control: Lady bird beetles, *Chilocorus nigrita* and *C. circumdatus* are found to be effective predators against the scale insects attacking arecanut. These can be released in affected areca garden to control the scale insects.



Mite infested leaves



Scales on nuts



Tender nut drop



Halyomorpha damaged nuts



Mite infested seedling



Pentatomid bug

Nursery

- Watering may be continued. Shade may be reduced in the nursery on receipt of one to two good summer showers

Young garden

- Selection of site and laying out for new plantation
- Pits of 60 cm³ should be taken 2-3 weeks before planting to ward off the field heat. While digging top and bottom soils should be heaped separately. Pit should be half filled with top soil and 5-10 kg Farm Yard Manure (FYM) one week before planting. Seedlings should be planted in the centre of the pit, pressed around, mulched and shaded

Old garden

- If first dose of fertilizers were not given during April, it can be given in May in irrigated arecanut gardens
- Application of first dose of fertilizers to supply 35g N, 15g P₂O₅ and 50g K₂O per palm can be taken up in rainfed gardens after receipt of sufficient showers
- Irrigate palms during hot and dry periods at regular intervals of 3-5 days depending upon the soil type and availability of water for irrigation
- Sow seeds of green manure cover crops such as *Mimosa invisa*, *Stylosanthes gracilis*, *Calapagonium muconoides* and *Pueraria javanica*, in April-May with onset of pre-monsoon rains. The seed rate required per hectare is 15 kg, 9 kg, 11 kg and 11 kg respectively. These crops may be cut and incorporated during October
- Before the onset of south-west monsoon, dried leaves and diseased palms should be removed. 1% Bordeaux mixture may be sprayed as a prophylactic measure to avoid *Phytophthora* related problems in high rainfall areas
- Control root grub

Root grub (*Leucopholis burmeisteri* Brenske)

Symptoms: Grubs feed on growing roots. Infested palms show a sickly appearance with yellowing of leaves, tapering of stem and reduction in yield.

Control: Provide good drainage facilities. Loosen soil around the base of palms to a depth of 10-15 cm and drench with Chlorpyrifos 0.04% suspension twice, once in May just before the onset of south-west monsoon and again in September-October towards the close of the monsoon. Repeat application for 2 or 3 years consecutively to secure a complete eradication of the pest. Collect adult beetles in the evening hours of 6.30-7.30 PM, after 8-10 days of pre-monsoon showers and kill them. Phorate can also be used instead of Chlorpyrifos. Apply 15 g Phorate (Thimet 10G) per palm twice a year during May and September-October and repeat it for 3 years. Apply organics like neem cake (2 kg/palm/year) for improving the soil structure and thereby enabling the regeneration of roots. Sow seeds of cover crops which will also control root grubs.



Root grub affected garden



Root grub affected palm



Grub eaten roots of seedling



Grubs at palm base



Stages of grubs excavated



Adult beetles

JUNE

Nursery

- Regular removal of weeds
- Monitoring for incident of any diseases especially die back disease
- Providing sufficient drainage and cleaning of channels
- Control of collar rot and leaf blight

Young garden

- Establishment of garden in well drained soil
- Take up transplanting in the beginning of south-west monsoon or the first week of June in low rainfall areas which is the best season
- While digging the pits, the rows may be aligned in north-south direction by deflecting the north-south line at an angle of 35° towards west to minimize sun scorching
- Suitable shade trees may be planted on southern and south-west side.
- After planting pit should be mulched with green leaves
- Cover the seedlings with plaited coconut leaves and grow shade crops like banana in the interspaces
- Sunhemp (green manure crop) seeds @ 20 kg/acre may also be sown in the interspaces as a soil reclamation measure and to avoid weed growth

Old garden

- Remove drip lines from the garden, roll back and keep safely for use during post monsoon season. This will prevent the pipes/tubes from soiling and clogging
- Adequate drainage should be provided in the arecanut gardens during the rainy season. Open new drains or deepen and clean the existing ones so that the channel should be 25-30 cm deeper than the bottom of the plant base
- To rejuvenate old gardens, underplanting/replanting may be taken up in a phased manner over a period of 3 to 4 years. If the existing garden is irregularly spaced, thin out old and unproductive palms
- High humidity alternating with bright sun shine and rain favour the incidence of Fruit rot. Prophylactic spraying with 1% Bordeaux mixture will provide adequate protection to the bunches against disease incidence. Spraying operations may be undertaken on clear sunny days with a very fine spray so as to give a protective coverage on the entire nut surface with fungicide
- Besides chemical control, mechanical method of control of the disease, by protecting the bunches through polythene covering is found to be very much effective in checking the incidence and spread of the disease

Diseases of seedlings

Collar rot (*Fusarium sp.* and *Rhizoctonia sp.*)

Symptoms: This is common in secondary nurseries and field planted seedlings. Infection by the pathogen is through collar region or root. Infection through collar region causes rotting of the growing bud, while root infection leads to seedling wilt.

Control: Providing good drainage and soil drenching with 1% Bordeaux mixture will reduce the incidence.

Leaf blight (*Pestalotia palmarum* Cooke and *Phomopsis palmicola* Wint.)

Symptoms: This is due to different fungal pathogens. Reddish brown spots are formed on the leaf lamina. Severe disease leads to stunted growth of the seedling.

Control: Incidence of blight can be reduced by providing sufficient shade and spraying with Dithane Z78 @ 4g/l of water or 1% Bordeaux mixture.

Leaf spot (*Colletotrichum gloesporioides*)

Symptoms: Leaf spot in arecanut seedlings and young palms is observed in different seasons both during summer and south-west monsoon period. 1-2 years old seedlings are affected during summer with yellow specks of 3-10 mm diameter, which later coalesce to form bigger lesions with yellow halo around. Severe infection cause stunted growth and death. During monsoon leaf spot affects palms of less than 10 years old and the infection restricted to 3-4 leaves of outer whorl. Spots are round to varied sizes, brown to dark brown in colour with a yellow margin around and advanced stages form blighted patches. Severe infection causes drying, drooping and shedding of leaves.

Control: Leaf spot seen on seedlings during summer can be reduced by providing proper shade and spraying with Dithane Z78 @ 4g/l of water or 1% Bordeaux mixture. Severely affected leaves may be removed and destroyed to avoid further spread of the disease. During monsoon season spray Dithane M45 @ 3g/l of water.

Preparation of 1% Bordeaux mixture

Dissolve 1 kg copper sulphate crystals in 50 liters of water. In another vessel containing 50 liters of water, prepare milk of lime with 1 kg quick lime. Pour the copper sulphate solution into the milk of lime slowly stirring the mixture all the while. Test the mixture before use for the presence of free copper, which is harmful to the plant by dipping a polished knife in it. If the blade shows a reddish colour, add more lime till the blade is not stained when dipped afresh in the mixture. Always use wooden or earthen or copper vessels for the preparation of Bordeaux mixture. For preparation of 10% Bordeaux paste, 100 g copper sulphate and 100 g quick lime each are dissolved in 500 ml of water separately and mixed thoroughly.

Nursery

- Intermittent removal of weeds is necessary otherwise all nourishment will be taken away by the weeds
- Mechanical killing of insects like grass hoppers and caterpillars may be done
- Burning of diseased plants is advisable
- Removal of shade nets during rainy season
- Improve the drainage facilities

Young garden

- Replace the weak and dead seedlings by gap filling
- After removal of diseased plants drench the pit and surrounding pits with suitable fungicide
- Soil bunding at the base and anchoring the young seedlings during rainy season
- In young plantations, weeding should be done once in 3 months
- In grown up gardens, weeding should be done once in 6 months
- Care should be taken not to damage trunk and roots of young plants while weeding

Old garden

- Ensure drainage facilities
- Second round of spraying with 1% Bordeaux mixture may be taken up 40-45 days after the first spraying
- Control leaf spot and nut splitting
- Control bud, crown, fruit and root rots

Diseases of palms

Bud rot and Crown rot (*Phytophthora meadii*)

Symptoms: Bud rot is characterized by initial yellowing of spindle leaf, rotting of growing bud which can be removed easily with a gentle pull, followed by infection in surrounding leaves. Crown rot can be identified by its characteristic symptom of green drooping leaves followed by yellowing of leaf sheaths and leaves of the outermost whorl. Inner portion of the affected leaf sheath shows clear water soaked lesions. The spear leaf remains green till the bud portion is fully damaged. The developing inflorescence also rots. In the advanced stages all the leaves become yellow, droop, dry up and remain attached to the stem and inner stem tissue becomes discolored and shows varying degrees of rotting. The infected palms are killed and the top portion of the stem gets cut off at the point of infection. Both rots occur during south-west monsoon season and continue to appear even after cessation of rains till the end of winter months (October-February). The rarely occurring summer showers, cool nights with low temperature and dew fall in winter favors the pathogen growth.

Control: Bud rot can be controlled if the affected palms are treated in the initial stages of infection. Drenching the crown with 1% Bordeaux mixture and smearing with 10% Bordeaux paste after removal of affected tissues is effective in saving bud rot affected palms. The crown areas of the palms have to be well protected through mist spraying to check the occurrence of both rots. Phytosanitation is also equally important to minimize the inoculum load in the plantation. Since the fungus can survive throughout the year, removal and destruction of fruit rot affected, dried bunches, shed nuts and the crowns of the palms affected by bud/crown rots may help to maintain the health of the plantations.

In case of crown rot during initial stage of infection root zone of the palms may be drenched with salt of phosphorous acid (Akomin) or Tridemorph (Calixin) @ 0.3% concentration (3ml/ 1 l of water). Minimum 5 litres of fungicidal solution/palm (15 ml fungicide in 5 l water) is required for drenching. Regular monitoring of treated palms is needed for checking further advancement of symptoms. When drooping has just advanced to the inner whorl, the crown may be sprayed with any one of the above fungicides at the specified concentration. The bunch bearing nodes, leaf sheaths, leaf bases and stem portion are to be thoroughly sprayed to check further spread of infection. However, palms may not respond to any treatment once the bud portion is fully damaged. Spray or drench 1% Bordeaux mixture to the crown of healthy palms which are in the vicinity of the affected palm to reduce the incidence further.



Bud rot



Rotten bud



Crown rot initial stage



Crown rot later stage

Fruit rot or Koleroga or Mahali (*Phytophthora palmivora*, *P. meadii*)

Symptoms: Rotting and heavy shedding of fruits seen during south-west monsoon (June-September). Dark brown water soaked lesions are formed near the perianth end and spread gradually covering the entire surface of fruit and finally shed. Infected nuts showed discoloration of kernel, reduction in weight and large vacuole. At the end of monsoon the fruits dry up, remains mummified without shedding.

Control: Spray 1% Bordeaux mixture to the bunches at least two times at an interval of 45 days. The first spray should be given just before the onset of south-west monsoon and if the monsoon prolongs, a third spray is essential. Use resin or soap adhesive to ensure tenacity of the spray deposit on treated substrate. Collect all the infected nuts and other plant parts and destroy them.

Foot rot or Basal stem rot or Anabe roga (*Ganoderma lucidum*)

Symptoms: Initially there is yellowing of outer whorl of leaves gradually extending to inner whorls. As the disease progresses the entire crown becomes yellow leaving only the spear leaf green. In the advanced stages, spindle also gets dried up and finally the crown drop off leaving the base stem. At the basal portion of the stem small dull brown spots occurs which later coalesce to bigger patches at 1 m height of the trunk from ground level. At acute stage brown gummy liquid oozes out and bracket shaped fruiting bodies formed at the base of the trunk after death of palms. Rotting of roots and internal tissues of the basal portion of the stem occurs and it is difficult to identify the disease in the early stages of infection.

Control: Proper management of the garden is the best way to check the disease. Improve the drainage. Drench the root zone with 0.3% Calixin (3ml/l) @ 15-20 l/palm + Root feeding 1.5% Calixin (15ml/l) @ 125 ml/palm at quarterly intervals. Apply 2 kg neem cake per palm per year. Phytosanitary measures like cutting and burning of the dead palms along with bole and roots should be followed strictly. Isolate the diseased palms by taking trenches of 30 cm width and 60 cm depth around the palm and surrounding palms may also be drenched as a precautionary measure.



Fruit rot



Foot rot

Areca sprayer

CPCRI has developed an arecanut sprayer with light weighted telescopic pipe assembly which is adjustable upto 7 ft height. This sprayer makes the chemical application easier in gardens with uniform crop stand and plots with less undulations. The cost of arecanut sprayer is Rs. 12,500/-.



Fine mist spray



Arecanut sprayer

Yellow leaf disease (YLD)

Symptoms: This is caused by *Phytoplasma* and transmitted by the vector plant hopper, *Proutista moesta*. Yellowing of leaves is the main symptom. Yellowing starts from the tip of the leaflets of the outer leaves and sometimes seen in the middle whorl. Yellowing spreads gradually extending from the margin to the middle of lamina portions near the midrib which remain green. In advanced stages, yellowing spreads to all leaves completely and they dry and fall off. Kernel of the nuts of affected palms become soft, show blackish discolouration and assumes a spongy texture.

Management: Since the disease is not amenable to control by conventional protection measures, other means of controlling the disease have to be adopted. Yield of the disease affected garden can be sustained by adopting the recommended management practices such as balanced fertilizer application (NPK@100:40:140g/palm/year) and application of additional dose of super phosphate (1kg/palm). Application of organic manure @ 12kg/palm/year along with provision of summer irrigation and drainage can improve the condition of the palms.



YLD affected palm



YLD affected leaf

Disorders

Nut splitting

Symptoms: Areca palms in the age group of 10-25 years are more prone to this disorder. This is prevalent in paddy field converted lands as well as gardens with high water table and seen during rainy season. Sudden flush of water after a long period of drought is the main cause. Initial symptom appears as premature yellowing of nuts when they are half to three fourth mature. This is followed by splitting of nuts from either sides or the tips which expand longitudinally towards the calyx exposing the kernel.

Control: Improvement of drainage in gardens will minimize this disorder. Application of potash fertilizers and spraying of Borax 0.2% in the early stage reduces the splitting.

Band disease

Symptoms: This may be due to improper drainage or physiological disorder. Symptoms include small crinkled dark green leaves, tapering stem and reduced internodal length. Roots are poorly formed and they are brittle, short and crinkled.

Control: Provision of good drainage and better soil management are important to reduce this disorder. Removing hard pan of sub soil and application of micronutrients are effective measures to reduce the disease intensity. Generally balanced application of organic and inorganic fertilizers, macro and micro nutrients can be taken up after soil testing.



Crown twisting



Nut splitting



Band symptom

Nutrient deficiency symptoms

Nutrient	Deficiency symptoms
Nitrogen	• Restricted growth • Yellowing of foliage • Small leaves • Yellowing followed by drying leading to light brown colour • Abscission of leaves
Phosphorus	• Scorched margins in leaflets • Yellowing between veins in lower leaves but often showing a tendency to develop a purplish coloration on the leaf sheath • Poor vegetative growth
Potassium	• Leaflets bluish green and slight interveinal chlorosis • Downward curling of leaf margins • Dead tissues around the margins and between the veins of the leaves • Stunted growth
Calcium	• Mosaic type chlorosis on the foliage • Death of growing point
Magnesium	• Lower leaves chlorotic and show spotting in later stages • Chlorosis starts at the leaf tip progressing downwards and inwards along the margins and between the veins • Upward curving of leaf margins
Boron	• Mottled chlorosis starting at the tip of older leaves • Interveinal chlorotic streaks which may merge to form necrotic lesions • Small flowers and fruits • Death of growing point
Imbalanced nutrition	• Formation of oblique rings near the crown • Twisting of stem • Crown choking • Crinkling of leaves • Bulky stem

AUGUST

Nursery

- Weeding and supervision for any disease incidence
- Drenching the seedlings depends on severity of disease incidence
- Resowing in ungerminated polybags when rains subsided
- Ensure proper drainage in the nursery

Young garden

- Soil bunding and anchoring the young seedlings
- Supervise for the condition of drainage channels. Channels blocked with muddy soil, stones and plant wastes should be cleaned

Old garden

- Improve the sanitation in the garden by removing fallen rotten leaves and inflorescence bunches
- If the monsoon prolongs, third round of spray with 1% Bordeaux mixture against the incidence of fruit rot disease may be given
- In the case of bud rot affected palms, the damaged tissues may be scooped out. Remaining healthy tissues should be treated with Bordeaux paste or the crown drenched with 1% Bordeaux mixture and protected suitably from rain
- Control spindle bug
- Harvesting for tender nut processing may be started

Spindle bug (*Carvalhoia arecae* Miller)

Symptoms: The bug population is peak during August-September and generally high during monsoon and post monsoon periods. Both the nymphs and adults suck the sap and form linear dark brown necrotic lesions on the tender spindle and leaves. Severely infested spindles fail to open fully.

Control: Spraying the spindles with Dimethoate (Rogor 30 EC) 15 ml/10 l of water will effectively control the pest. Very fine spraying must be done, avoiding the sunny hours of the day. Placement of 2 g Phorate granules (Thimet 10G) in perforated poly-sachets in the innermost two leaf axils of areca palms at an interval of 3 months is an effective practice for maintenance of the gardens free of spindle bugs in severely infested tracts.



Spindle bug



Infestation on spindle



Phorate sachets in axils

SEPTEMBER

Nursery

- Weeding and supervision for any disease incidence
- Watering depends on continuity of rain

Young garden

- Planting at the end of monsoon in high rainfall areas, particularly plots with high water table and clayey soils
- Banana may be planted between rows to provide shade to arecanut in the initial stages upto 4-5 years
- Soil bunding and anchoring the young seedlings, mulching and shading
- Sunhemp plants may be cut and incorporated in the basins before they attain flowering stage

Old garden

- Forking and fertilizer application (second dose)
- Young palms need to be given only graded doses *i.e.*, one third and two thirds of fertilizers in the first and second year, respectively. As the south-west monsoon generally recedes in September-October, the second round of fertilizers application may be taken up to supply 65g N, 25g of P_2O_5 and 90g K_2O per adult palm in circular basins of 15 to 20 cm deep taken at a radius of 75 cm to 1 m away from the base of the palm. Organic manures may be added during this season which will enhance soil microbial activity and recycling of minerals
- In acid soils, 15 days prior to application of fertilizers apply lime @ 1 kg per palm and incorporate in the soil by forking. Lime can be applied once in two years
- For high yielding varieties, double dose of inorganic fertilizers can be applied for higher yield. Application of 12 kg organic manure as green leaf compost/farm yard manure is recommended per palm
- Intercultivation may be practiced
- Watch the palms carefully for incidence of bud rot and if noticed scoop out the rotten tissues, wash the surface, apply Bordeaux paste and protect from rain
- In case of crown rot, remove the infected bunches properly and control the disease during initial stages of infection by drenching the soil and advanced stage by spraying
- Control spindle bug
- Harvesting for tender nut processing may be continued

Inter cultural operations

The cultural operations like forking of interspaces vary from area to area. Soil should be loosened with light digging in October-November. Terracing and contour bunding should be provided in undulated lands to prevent soil erosion. In *Malnad* tracts the main purpose of intercultural operation is to loosen the soil and to rebuild the soil fertility after the heavy rains during monsoon. In *Maidan* tracts it is to conserve the soil moisture and prevent the hardening of the heavy soils. In general, the cultivation has found to increase the yield by 10-20%. In light soils digging the soil can be done once in two years. But in heavy soils digging has to be done every year. Clean cultivation has found to give better yield with lesser weeds.



Compost application



Forking interspaces

Tender nut processing

If the market requirement is for the processed tender nuts, harvesting green fruits at an appropriate stage of about 6 months maturity is essential since it fetches more price. The tender nut processing consists of dehusking, cutting the soft nuts into pieces, boiling cut pieces with water or dilute extract from a previous boiling, coating with kali (a concentrated, thick extract obtained after boiling 3-4 batches of arecanut) to get a good glossy appearance and drying. Both sun and oven drying can be adopted. This red type of processed tender nut is called *kempadike* or *kalipak*. This is usually used for making scented supari. Saraku, Kempu Bette, Kappu Bette, Aluvu (Batlu), Chikani, Nuli and Gorablu are different grades of tender nut.



Dehusking tendernut



Tendernut drying

OCTOBER

Nursery

- Weeding and supervision for any disease incidence
- Watering depends on intensity of rain

New garden

- Soil bunding and anchoring the young seedlings
- Forking and fertilizer application (second dose if not applied during September)

Old garden

- Plant protection
- Scything and weeding, as and when required
- Forking and ploughing of interspaces in monocropped gardens may be practiced
- If not applied in September, apply manures and fertilizers
- Incorporate the green manures grown as cover crops
- In low lying areas to cover the roots, fresh earth may be applied on exposed portions
- Control spindle bug and root grub

NOVEMBER

Nursery

- Weeding
- Watering depends on intensity of rain
- Plant protection

Young garden

- Installation of drip lines and tubes
- Irrigation once in a week
- Soil bunding and anchoring the young seedlings
- Mulching may be done in young areca plantations with areca leaves

Old garden

- Weeding in plantation
- Irrigation of areca gardens and nursery may be started on receding of monsoon showers
- Palms exposed to south western sun may require protection against sun-scorch and consequent stem breaking. In such cases green portions of the stem may be covered with areca leaf sheaths or opaque polythene film
- Control spindle bug
- Harvesting for chali may be started

Harvesting and processing

Harvesting of nuts at correct stage is very important for obtaining the produce of better quantity and quality. It should be ensured that fully ripe nuts alone are harvested for preparation of chali or *kottapak*. Unripe or under ripe nuts leads to more of lower grade nuts which ultimately fetches lower prices in the market. The harvested nuts will have to be sun dried for about 45 days in flat surfaces. It is essential to spread the nuts uniformly in a single layer for drying. Turning of the nuts once in a week may be done for ensuring uniform drying and better quality of produce. Proper drying of the nuts is important to prevent fungal infection of the nuts in the drying yard. Mechanical flow driers are available for making chali. In such systems drying takes place for 60-70 hours. Dehusking and grading is practiced thereafter. A dehusking device has been developed to remove husk from dry arecanuts by CPCRI. The cost of dehusker is Rs. 3,500/-. Depending on size and quality, grades are made and marketed. The well known grades are Moti, Srivardhan, Jamnagar and Jinni. The out turn of patora and koka will be more if unripe or under ripe nuts are harvested. As a byproduct utilization measure arecanut leaf sheaths are being used in preparation of eco-friendly and biodegradable plates with the help of leaf sheath plate making machine.



Climbing



Harvesting



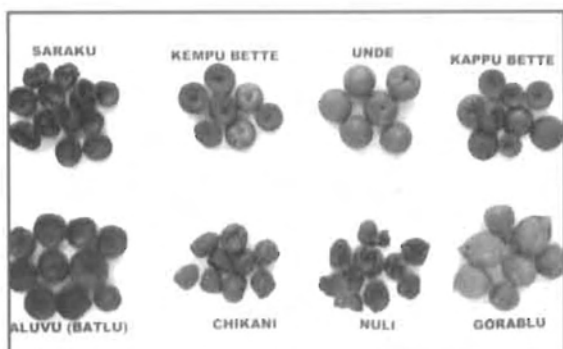
Drying for chali



Dehusking



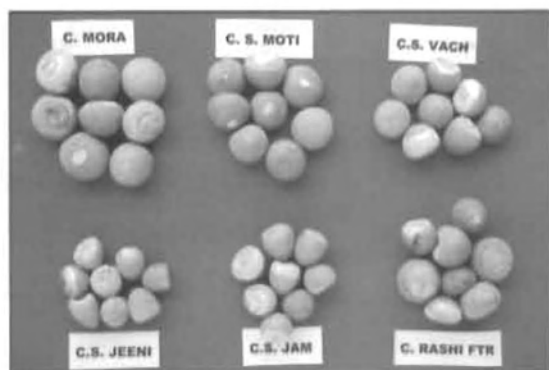
Tendernut boiler



Tendernut grades



Arecanut dehusker



Chali grades



Leaf sheath plate making machine



Leaf sheath products

DECEMBER

Nursery

- Weeding
- Daily watering
- Shade net covering in the nursery

Garden

- Clean the irrigation channels and commence irrigation once in a week @ 175 liters of water per application. In gardens where there is shortage of water, drip irrigation may be adopted
- Fertigation may be started and continued upto May
- Weeding
- Protect the palms from sun-scorch
- Harvesting and drying of ripe nuts
- Selection of mother trees and harvest the selected bunches carefully for seed nuts
- Sowing seed nuts in the primary nursery

Cost of seedlings (Variety-wise)

S.No.	Variety	Rate/ seedling (Rs.)
1	Sprouts (all varieties)	5
2	Mangala	10
3	Sumangala	10
4	Sreemangala	10
5	Mohitnagar	10
6	Swarnamangala	10
7	Hirehalli Dwarf	15
8	VTLAH-1 (Dwarf hybrid)	20
9	VTLAH-2 (Dwarf hybrid)	20

Marketing facilities

a. CAMPCO

Governments of Karnataka and Kerala joined together in 1973 and established the Central Arecanut Marketing and Processing Co-operative Limited, popularly known as 'CAMPCO' for procurement and marketing of arecanut under Multi State Co-operative Societies Act, 1984 which is a boon to farmers.

Contact Address

The President, CAMPCO
Varnashi Towers, Post Box No. 223, Mission Street
Mangalore, Karnataka.
Phone : 0824-2422398
Email: campco@bsnl.in

b. MAMCOS

The Malnad Areca Marketing Co-operative Society Ltd, which is popularly known as 'MAMCOS', has the revenue districts of Shimoga and Chikmagalur and revenue taluks of Honnali and Channagiri of Davangere district as its jurisdiction. These areas are famous for areca production. This society was established with the purpose of safeguarding the interest of arecanut growers.

Contact Address

Managing Director
MAMCOS
APMC YARD, Sagar Road
Shimoga, Karnataka.
Phone 08182- 250513, 250514

Persons to be contacted for planting materials & details

1. Head, CPCRI Regional Station, Vittal, Karnataka- 574 243.
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3. Director, Directorate of Arecanut and Spices Development, Calicut, Kerala - 673 005.

Directorate of Arecanut & Spices Development (DASD)

DASD was established on 1st April, 1966 and functions under the Ministry of Agriculture, Government of India.

Mandate

Overall coordination of all the development activities implemented by different agencies in the mandatory crops and monitors the implementation of National Horticulture Mission in respect of spices and aromatic crops.

- Production and Distribution of Quality Planting Materials
- Establishment of Nursery Centres for Aromatic & Medicinal Plants
- Establishment of Seed Processing and Storage Infrastructure
- Technology Dissemination through Frontline Demonstrations
- Organizing national level seminars & workshops

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