

METHODS OF ARECANUT CULTIVATION

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Introduction

The areca nut palm is the source of common chewing nut, popularly known as **betel nut** or **Supari**. In India it is extensively used by large sections of people and is very much linked with religious practices. India is the largest producer of areca nut and at the same time largest consumer also. Major states cultivating this crop are Karnataka (40%), Kerala (25%), Assam (20%), Tamil Nadu, Meghalaya and West Bengal.



Areca Nut- Plant



Bunch ready for Harvest



Harvested bunch



Single fruit



Areca-nuts



Betel leaves and Areca nut



Disposable Areca-Leaf Plates

Climate

The cultivation of arecanut is mostly confined to 28° north and south of the equator. It grows well within the temperature range of 14°C and 36°C and is adversely affected by temperatures below 10°C and above 40°C. Extremes of temperature and wide diurnal variations are not conducive for the healthy growth of the palms. Arecanut can be grown in areas receiving annual rainfall of 750 mm in *Maidan* parts of Karnataka to 4,500 mm in *Malnad* areas of Karnataka. In areas where there is prolonged dry spell, the palms are irrigated. Due to its susceptibility to low temperature, a good crop of arecanut cannot be obtained at an altitude of more than 1000 m MSL.

Soil

The largest area under the crop is found in gravelly lateritic soils of red clay type. It can also be grown on fertile clay loam soils. Sticky clay, sandy, alluvial, brackish and calcareous soils are not suitable for arecanut cultivation.

VARIETIES

Local Varieties:

- **Theerthahally Local**
 - * Tall Variety
 - * Takes 6-7 years for bearing
 - * Medium sized oblong nuts
 - * Drooping bunches
 - * Suitable for tender processing
 - * Suitable for malnad and maidan area
 - * Average yield/palm 2.6 kg/palm
 - * Susceptible for hidimundige disorder in maidan area
 - * Tall variety



- **Maidan Local**
 - * Medium sized round nuts
 - * Erect bunches
 - * Takes 5-6 years for bearing
 - * Suitable for maidan area
 - * Suitable for tender processing
 - * Average yield/palm 2.6 kg/palm
 - * Less susceptible for hidimundige disorder



- **South Kenra Local**
 - * Tall variety
 - * Big size round shaped nuts
 - * Suitable for chali preparation
 - * Average yield 2.0 kg/palm
 - * Suitable for coastal area
- **Mohith Nagar**
 - * Tall variety
 - * Local variety from West Bengal
 - * Round to oblong medium size nuts
 - * Suitable for chali preparation
 - * Average yield 3.60 kg/palm
 - * Spouse setting of nuts in bunches
 - * Suitable for coastal and maidan belt
- **Srivardhan**
 - * Tall variety
 - * Grown in Maharashtra State
 - * Medium size round nuts
 - * Average yield 2.0 kg/palm
 - * Suitable for tender processing
 - * Very good quality nuts fetches highest market price



IMPROVED VARIETIES

MANGALA

- * Medium sized tree
- * Starts bearing in 4-5 years
- * Medium sized round nuts
- * Average yield 3.0 kg/palm
- * Suitable for chali preparation
- * Recommended for coastal belt



SUMANGALA

- * Tall variety
- * Medium sized oblong nuts
- * Takes 5-6 years for bearing
- * Average yield 3.18 kg/palm
- * Suitable for chalii preparation
- * Recommended for coastal belt

SRIMANGALA

- * Tall variety
- * Big sized round nuts
- * Suitable for chali preparation
- * Recommend for coastal belt
- * Average yield 3.28 kg/palm



SARWAMANGALA (VTL-12)

- Regular bearer, consistent yielder with homogenous population
- Trees are semi tall to tall, stem sturdy with shorter internodes
- Having partially drooping crown with well placed bunches
- Average no. of bunches/palm/year - 3.90
- Color of ripe nuts - Orange to deep yellow
- Shape of ripe nuts - Oblong to round and bold
- Bearing - By 4th year
- Potential yield (kg chali/palm/year) - 6.28
- Average yield (kg chali/palm/year) - 3.88
- Recovery - High recovery with 26.52% of chali from fresh nut
- Recommended regions/areas for cultivation- Irrigated areas of Karnataka and Kerala



SAS-I

- * Tall type released by UAS, Dharwad
- * Medium sized round nuts
- * Average yield 4.60 kg/palm
- * Suitable for both tender processing and chali type
- * Recommended for North Kenara and Malnad area



Vittal Areca Hybrid- 1 (VTLAH-1)

- Hybrid between Hirehalli Dwarf x Sumangala.
- Dwarf type with reduced canopy and very sturdy stem.
- Super imposition of nodes on the stem gives mechanical support to palms.
- Partially drooping crown with well spread leaves.
- Moderate yielder but early stabilization in nut yield.
- Medium sized oval, yellow to orange nuts.
- Average yield (kg chali/palm/year)- 2.54.
- Yield (kg/ha)- 5248.
- Recovery over fresh nut- 26.45 %.
- Specific recommendation for seed production- Artificial crossing is suggested between Hirehalli Dwarf and Sumangala for hybrid seed production. Only sprouts/seedlings will be supplied after sorting and selection in the nursery.
- Recommended regions/areas for cultivation- Coastal Karnataka and Kerala.
- Harvesting and spraying easy because of the dwarfing nature and lesser cost of cultivation.
- Sun scorching and wind damage is minimal due to dwarfing nature.



Vittal Areca Hybrid – 2 (VTLAH-II)

- Dwarf variety released by CPCRI Vittal
- Medium sized round nut
- Suitable for chali preparation
- Average yield 2.64 kg/palm
- Recommended for coastal belt

Vittal Areca Hybrid – 2 (VTLAH-II)



Raising of Seedlings

Arecanut is propagated only by seeds. There are four steps in selection and raising of arecanut seedlings viz., selection of mother palms, selection of seed nuts, germination and raising the seedlings and selection of seedlings.

Selection of mother palm

The criteria for the selection of mother palm are; early bearing, regular bearing habit, large number of leaves on the crown, shorter internodes and high fruit set. Middle aged palms of 15-30 years should be selected as mother palms in a garden of medium management.

Selection of seed nut

Fully ripened nuts having weight of above 35 g should be selected. The weight of seed nuts for red varieties should be 20-25 gms. The middle bunches should be selected for seed purpose leaving the first and the last bunch. The nuts selected should float vertically with calyx-end pointing upwards when allowed to float on water. These nuts produce the seedlings of greater vigour.



Primary and secondary nurseries

For obtaining good germination, the seed nuts should be sown as whole fruits. The nuts should be sown immediately after the harvest in soil or sand and watered daily to get early and good germination. The nuts should be sown at 15 cm distance in vertical position with calyx end just covered. The beds may be mulched lightly using areca leaf or paddy straw.

After six months in primary nursery, the seedlings are to be transplanted to secondary nursery beds of 150 cm width, 15 cm height and convenient length. A spacing of 30 cm between the seedlings is considered to be optimum for a growth period of one year in the nursery. Polythene bags (25x15cm, 150 gauge) filled with potting mixture (top soil : FYM : sand = 7:3:2) can also be used to raise secondary nursery. Sprouts of 3 months old should be used for transplanting in poly bags. The secondary nursery should be given a basal dose of decomposed farm yard manure@ 5 tonnes per ha. 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 nursery should be watered regularly in the summer and proper drainage should be provided in rainy season. The nursery should be kept clean by periodical weeding.

Selection of seedlings

Twelve to eighteen-month-old seedlings are to be selected and transplanted in the main field. Seedlings with maximum number of leaves (five or above), minimum height and maximum girth are to be selected for planting. The selected seedlings should be removed with a ball of earth adhering to the roots for planting. Poly bags raised seedlings establish very well in main plantation.

Selection of site and layout

The crop thrives well in humid areas protected well against hot sun and heavy wind. Since the areca palm does not withstand either water logging or drought, the site selected should have proper drainage and adequate source of water for irrigation. Arecanut palm cannot withstand extreme temperature and exposure to direct sun. So the site selected should have protection from southern and western sides. 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. Aligning the rows in north-south direction with a deviation of 35° towards southwest lowers the incidence of sun-scorch. A row of quick growing shade trees should be planted at a spacing of 5-6', 10-12' away from the last row on southern and western side to prevent sun scorching during winter season.

Spacing

This depends on the rooting pattern of the crop along with the fertility and depth of the soil. The studies conducted at different places with different spacing have revealed that a spacing of 2.7 m X 2.7 m is optimum for arecanut.

Depth of planting

In well-drained soils and in the fields where proper drainage can be provided, deep planting is preferred. Deeper planting provides a firm anchorage and larger volume of space for root development. In areas where water table is high, shallow planting is preferred. Thus in well-drained soils, planting at a depth of 90 cm is recommended and in heavy soils planting at a depth of 60 cm is recommended.



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 also be done in the months of May-June after on set of monsoon. In low laying areas where water logging is a common planting during September – October after south west monsoon is of the crops. Planting should be followed by provision of irrigation immediately after planting if there are no rains.

Method of planting

The pits should be opened 2-3 months in advance of planting season. The pits are filled up with a mixture of top soil and FYM / Compost in equal proportion to half portion of the pit and planting is taken up in the centre of the pit and properly staked. The remaining half portion of the pit is filled up gradually during the first 2-3 years manuring with soil and farm yard manure. This method of planting helps in better anchorage of roots and better roots spread and development.

Drainage

For better growth and development of the plants proper drainage is essential. The number of drainage channels depend 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 for proper draining of the excess water. The channels should be at least 15 – 30 cm deeper than the depth at which the seedlings are planted. Provision of drainage not only helps in draining out of excess rain water but also root aeration and development of feeding roots particularly in heavy soils. Maidan belts which receives less rain fall annually also require drainage whenever arecanut is grown in heavy soils and paddy converted soils. The sub drainage channels should have a width of 30cm and a depth

of 60-75 cm depending up on the depth of planting and type of soil. All around the garden a main drainage with a width of 60cm and a depth of 75-90 cm depending up on the soil should be provided for easy movement of excess water. The drainage channel should be opened across the slopes to prevent soil erosion. In case of heavy soils the depth of the drainage should be increased step by step to prevent the soil caving in to the drains. Every year the drainage channels should cleaned twice before and after south west rains, to facilitate easy movement of water.



Shading

The palms are highly susceptible for sun scorching. The seedlings should be given protection against the direct exposure to sun. This may be done either covering the plants with areca or coconut leaves or by raising crops like banana in between two rows of arecanut. Sun scorching is mostly seen during October – January. During this period even the stems of young palms have to be protected. For this a quick growing shade plant can be planted on Southern and Western sides of the garden. Planting of banana along with arecanut is a very good practice where banana provides shade to young arecanut plants at the same time giving additional revenue to the farmer in the farm of bunches.

Nutrient Requirement and Management

A perennial crop like arecanut which gives yield regularly require good nutrient management from the beginning of planting to give regular higher yield. For a bearing plant annual application of 100 g N (220 g urea), 40 g P₂O₅ (200 g rock phosphate) and 140 g K₂O (235 g muriate of potash) in addition to 12 kg each of green leaf and compost per palm per year is recommended. The fertilizers are to be applied in two split doses. One third of the fertilizer is applied in May - June and two third along with the organics during September-October. For one year old plant 1/3rd of the recommended dose, and for 2 year old plant 2/3rd recommended dose and for plant 3 years and above full dose is applied. Fertilizers are applied in basins around the palm dug to a depth of 15-20 cm and 0.5-1.0 m radius leaving 20 cm from the base of the palm. After application, the soil is rolled up and covered with organic matter and soil. In maidan areas where irrigation facilities are available the first dose of nutrient can be given during February-march and the second dose during September-October along with organic manures. Irrigation should be provided if soil moisture is not adequate during manuring period. The above recommended dose holds good for heavy rain fall belts of coastal and malnad area. However in maidan area where the soils are comparatively fertile the nutrients should be provided based on soil tests results. It is observed that micronutrients are applied indiscriminately without soil tests which is highly improper and may lead to nutrient toxicity. It is recommended to go for application of micronutrients only based on soil test results. In malnad areas where soils are acidic, agriculture lime should be applied once in two years based on soil test to improve the availability of nutrients. In case of maidan area where arecanut is grown in saline soils application of gypsum salt is recommended based on soil test.

Organic matter recycling

On an average, 5.5 to 6.0 tones of wastes are available from one ha of areca garden per year. This can be effectively used as organic source of nutrients for areca palms. But direct application of these wastes in the garden will take long time for decomposition and will not meet the nutrient demand of the crop immediately. Hence, these materials can be composted using earthworms effectively and used as organic manure in areca gardens.

To prepare vermicompost, areca wastes are chopped into small pieces of 10 cm and heaped. The heap should be mixed with cow dung slurry @ 10 kg / 100 kg of waste and kept

for two weeks with sprinkling water daily. Then the chopped material is arranged in beds of one-meter width and convenient length. Cement tanks or trenches can be used for this purpose. A layer of 10-15 cm waste material is alternated with 2 cm layer of cow dung over which earthworms are released at the rate of 1000 numbers per square meter. The wastes are converted into fine granular, odourless vermicompost within 60 days. During this period, the earthworm population is doubled. About 8 kg /palm/year of vermicompost meets the crop nutrient demand in terms of nitrogen. The two species of earthworms *Eudrilus eugeniae* and *Eisenia foetida* can be used. The practice of recycling of organic wastes in areca garden will help in meeting 50 % of the annual nutrient requirement of the crop. The practice will help in improvement of soils water holding capacity prevention of leaching of nutrients, increase in the activity of soil micro organisms and improvement of soil properties.

Cultural operations

Earthing up and inter cultivation

The cultural operations vary from area to area. In *Malnad* tracts the main purpose of cultivation is to loosen the soil and to rebuild the soil fertility after the heavy rains during monsoon. In *Maidan* tracts the purpose of cultivation is to conserve the soil moisture and prevent the hardening of the soil, as the soils are heavy in these areas. In general the cultivation was found to increase the yield by 10-20%. In light soils digging can be done once in two years. But in heavy soils digging has to be done every year. Clean cultivation was found to give better yield. In maidan areas frequent inter cultivation using heavy machinery is being practiced by the farmers. The practice has resulted in frequent root damage and poor root regeneration and reduced growth of arecanut palms. Hence frequent inter cultivation using tractor drawn implements is not desirable, as it may lead to soil compaction and poor root aeration. When planting is done on hill slopes, contour planting gave highest yields. Mulching is another operation being followed in the arecanut gardens. This checks evaporation during summer, erosion during rainy seasons and keeps the weeds under check. Chopped areca leaves, grass, arecanut husk and dry leaves collected from the forests can be used as mulch in areca gardens.

Application of external soil to areca gardens

In heavy rain fall areas of malnad and coastal belts the practice of application of external soil is being followed since the beginning of areca cultivation. Every year 3-5 cm depth of fertile top soil is washed away by big rain drops falling from arecanut fronds during monsoon period and addition of external soil is needed under the circumstances to maintain the soil fertility. It helps in conservation of washed out soil by rain. However it is observed in some of the locations the clay type of soil obtained from adjacent hillocks is also being added to areca gardens by the farmers. The practice may lead to poor aeration and root rotting problems. Which may lead to Hidimundige type disorder. It is a good practice to add soil obtained from top 60-75 cm depth from hillocks beside areca gardens. In maidan areas large quantity of tank silt is being applied now days to areca gardens indiscriminately by the growers. The practice has temporarily increased the arecanut yields but on a long run it has lead to soil compaction, hardening, poor root aeration, rotting and disorders like Hidimundige. So the practice of addition of tank silt on a large scale should be discontinued. Under circumstances where soils are highly sandy are highly clayey, the soil having different characters that is clayey soil for highly sandy soil and red sandy soil for highly clayey soil should be added in small quantity to improve the soil properties.

Irrigation

Arecanut cannot withstand drought for a long time. Being a perennial crop, once affected by water stress, it may require two-three years to regain the normal vigour and yield. The death of palms due to moisture stress is also not uncommon. Irrigation intervals of 5 and 10 days were found superior throughout the season. It is essential to maintain uniform soil moisture through out the year to get higher yields. The roots of arecanut palm should not be dipped in water as they should not be dried due to moisture stress. Requirement of water starts from the onset of winter season and increases further during summer. During November- December irrigation is provided once in 8-10 days, during January- February once in a week and during March-May once in 5 days interval. The quantity of water to be applied is about 175-200 lit per palm/irrigation.

During the summer, majority of the farmers face scarcity of water and it will be difficult to supply the required water to the palms. To overcome this problem, new irrigation methods were tried which can save water without affecting the yield of arecanut. They are sprinklers and drip irrigation methods. Sprinkler and drip irrigations can save 20 and 44 per cent water respectively. Under drip irrigation method about 12-18 lit of water is required per day/palm based on the season. Under drip irrigation method two drippers should be provided in opposite direction for each palm. Whenever sprinkler irrigation method is adopted it is essential to see that the soil is wet to a adequate depth and combines with sub soil moisture level. Sprinkler irrigation is suitable whenever mixed and inter crops are grown in arecanut gardens. Whatever may be the method of irrigation it is essential to see that the soil moisture reaches to a depth of 60cm from the surface level.

Drip-Irrigation technique for Arecanut

Fertigation:

Application of nutrients through irrigation water is called as fertigation. This procedure can be profitably followed in arecanut. The studies at CPCRI have shown that in the initial stages of areca garden only 75% of the recommended dose of fertilizer is sufficient when the fertilizer was given through drip irrigation. The fertilizer should be split into ten parts and should be applied once in 20 days from November to May.

Arecanut based cropping systems

Arecanut is cultivated with spacing of 2.7 X 2.7 m provides ample scope for cultivation various annual by biennial and perennial crops in the inter spaces. Banana, pepper, cocoa, elephant foot yam, citrus, betelvine, pineapple etc. were found suitable for inter/mixed cropping in arecanut. However, it is found that as the age of the garden advances, only few crops can be grown profitably as mixed crop viz., pepper, cocoa, banana, lime and betelvine.

In a pure crop of arecanut only 31% of the land area is utilized by the main crop and remaining 69% area is available for growing of inter and mixed crops. So based on the availability of water, land area, labour, market demand suitable inter and mixed crops can be grown profitably in arecanut gardens. Among different inter and mixed crops the following crop combinations can be adopted in arecanut gardens.

In malnad and coastal area during initial 2-3 years Banana, Colocasia, Sweet Potato, Ginger and Turmeric can be grown profitably utilizing the moisture from South West monsoon. In maidan area where the rain fall is less vegetables crops like Bhendi, Beans, Cluster bean, Drumstick, Chilies and Fruit crops like Papaya and Pineapple can be grown profitably. Further flower crops like Jasmine, Tuberose, Marry gold can be grown as intercrops during the initial 2-3 years

Arecanut and Banana:-



Banana is good companion crop of arecanut during initial as well as later years. It provides the shade to arecanut plants during early period of plantation in addition to providing additional revenue to the farmer. Banana plants can be planted in between two arecanut plants within the

row or in the middle of four arecanut plants. Use of healthy suckers and systematic planting at a spacing of 2.7 x 2.7 mtrs, regular irrigation, nutrition is essential to get economic yield. During early state (first 2-3 years) both tall and dwarf banana can be grown in arecanut plantation. However in gardens more than 10-12 years age tall varieties like Poovan , Elakki bale, Kari bale, putt bale, Red banana should be grown to get economic yield. Control of Panama wilt, Banana Weevil and Bunchy top diseases is very important in banana cultivation. On an average an yield of 10-15 tons can be obtained per ha from the intercrop of banana

Arecanut and Cocoa:-



Cocoa is a profitable mixed crop in arecanut plantations more than 10-12 years of age in both malnad and maidan areas. Cocoa seedlings/grafsts planted at a spacing of 2.7 x 5.4 mtrs in between two arecanut rows. Since it is a deep rooted perennial crop it do not compete with main crop for water and nutrients. Cocoa adds lot of organic matter to the soil in the form of leaves and improves the physical and chemical properties of soil. Forester varieties are performing very well in both malnad and maidan belts. In cocoa cultivation regulation of canopy of cocoa tree by periodical pruning and training is very important to get economic yield without adversely affecting the performance of main crop. About 250 to 300 kgs of dry cocoa beans can be obtained per ha.

Arecanut and Black pepper :-



Black pepper is a good and profitable spice crop in arecanut plantations of more than 10-15 years. Rooted pepper cuttings obtained from a reliable nursery are planted 2-3' away from the arecanut palm in alternate rows. About 250-300 cuttings can be planted in one acre of arecanut gardens. In pepper cultivation selection of variety is very important to get economic yield.

Selections from Karimunda varieties like Shree kara, Subakara, Panchami and Pournami can be planted in middle of the garden and Panniyur selections can be planted to the border palms in the plantations. In pepper cultivation control of quick wilt is very important to get economic yield. On an average 150-200 kg of dry pepper can be obtained per acre. In maidan belt cultivation of black pepper is difficult because of sticky soil and high temperature.

Arecanut and Cardamom:-



Cardamom is a profitable mixed crop in more than 10-15 years old arecanut plantations. Malabar types of improved cardamom varieties Mudigere-1, Mudigere-2 and SKP-14 can be planted within arecanut rows between two palms. Use of virus free suckers/ seedlings is important to get economic yield. Control of katte disease and Thrips damage to the capsules is essential to get a profitable yield. Irrigation during summer months and keeping of Bee hives in the garden increases the yield of cardamom crop. About 150-200 kg of cardamom can be obtained from one ha area. In maidan belt cultivation of cardamom is difficult because of sticky soil and high temperature and water table in canal irrigated gardens.

Arecanut and Tree Spices:-



Trees spices like Nut mug, Clove and Cinnamon can be grown in malnad and coastal belts in middle aged arecanut plantations (15-20 years). Use of grafted/ budded plants is important to get higher yield. Tree crops are planted at a spacing of 6-8 mtrs between plants in between two arecanut rows. Some of the improved varieties are Burlier no-1, Nithyashree and Navyashree etc.

INSECT PESTS OF ARECANUT

Areca palm is attacked by over 120 insects and non insect pests. However, only a few of them are economically important. Mites, scales, spindle bug, pentatomid bug, root grub, inflorescence caterpillar and nut borer and are the major insect pests. Giant African snail, birds and squirrels are the non insect pests.

Scales (*Coccus hesperidum* and *Coccus acutissimum* and *saissetia* sp.)

Usually scales are tiny, flat/oval insects of various shapes and are sap feeding. Both nymphs and adults colonize lower surface of leaves, inflorescence and also on tender nuts. Severe infestation was noticed in neglected gardens during dry weather. Continuous desapping results in yellow patches and stunted growth.



Control Measures

Ants play a major role in transportation of scales from one plant to another. Identify the ant nests and drench chlorpyriphos (5ml/liter) around the ant nests. Spray spinosad (0.5ml/litre) or bufrofezin (1ml/litre) or neem oil (4ml/ 1 liter) or chlorpyrifos (2.5ml/litre) on leaves, inflorescence and tender nuts for the effective management. Release coccinellid beetles @ 6-8 beetles/palm as bio agents.

Mealy bugs(*Icerya seychellarum* and *Pseudococcus cryptus*)

An another group of sucking pest which infests almost all parts of areca palm viz., leaves, inflorescence, spadices, sheaths and developing nuts. Peak incidence will be noticed after August till the monsoon begins. Both nymphs and adults desap the plants which results in twisting of leaves, shortened leaves and small internodes, nut dropping accompanied with loss in nut weight and quality. Ants serve as transporting vehicles for the mealy bugs.



Control Measures

Plant protection for this pest remains same to that of arecanut scales.

Areca nut borer(*Tirathaba* sp.nr *rufivena*)

A lepidopteran moth which is brownish white and is of medium size. Dark slate caterpillars attack the tender nuts during August-September and bore into the nuts. Affected nuts shows webbed excreta with circular holes. Such nuts will dry and remains in the bunches for long time. Slowly the pest is gaining importance in malnad region.



Control Measures

Remove the affected nuts from the trees and burn them. During August-September, spray thio dicarb (2g/litre) or Indoxacarb (0.5ml/litre) on arecanut bunches.

Snails (*Achatina fulica*)

This is also called as giant African snail which has become one of the problematic pest in arecanut garden in rainy season. These are nocturnal and polyphagous in nature with hard protective shell on their body. They scarpe the chlorophyll content on the soft portion of the stem near crown, leaf and inflorescence.



Control Measures

Keep rotting papaya fruits or banana leaves in heaps or metaldehyde (20g/spot) @ several places in the garden. Snails get attracted and are to be collected and killed.

Squirrels and Birds

Destruction of forest lands and conversion them into agricultural lands, and also cultivation of sole crops are the main reasons for non availability of food and shelter to squirrels and birds which forced them to feed on arecanut. They scrape near perianth of tender nuts and suck the juice content resulting in nut dropping. Apart from this, birds (parakeets) reside on the leaves during night time. Leaf drooping, shredding and excreta on leaves are the common symptoms.



Control measures

Bait traps are helpful in trapping squirrels and birds. Drum beating, use of crackers, shouting, epigie or tieing with coloured ribbons helps to scare away the birds. Trap Squirrels and parakeets with nets and release them to the distant forest areas.



Spindle bug (*Carvalhoia arecae*)

This is a serious pest which causes considerable damage especially in South and Central Kerala and in some parts of Kanataka. The adult bug measures about 6.0mm long and 2.8mm broad and multiplies rapidly with close of monsoon (August to September). The red and black adults and greenish nymphs colonize the spindle and damage the unopened spindle leaf. The bug sucks sap from the tender spindles resulting in reduction in size of the spindle and twisted growth. The spindles fails to unfurl completely and do not attain their normal size. While sucking, the bug injects toxic saliva which liquefies the cell content. The infested portions on the lamina get discoloured and develop typical linear brown lesions and gives rise to necrotic patches which later form shot holes. Finally the leaves become dried, shredded and hang down giving sickly appearance like broomsticks. Severe leaf damage in grown up plants; fails to open the inflorescence and bearing of nuts.



Control Measures

Spray crowns with Lambda cyhalothrin(1ml/litre) or Azadirachtin (2ml/litre) or carbaryl (4g/litre) or Rogor (1.5 ml/litre) . The spray should reach the leaf axils. Repeat spraying after 30-35 days if pest incidence continues.

Filling the inner-most leaf axils around the spindle with Phorate granules (10 g/ palm) at 3 months intervals is effective. Conveniently this can be placed in sachets of 2 per tree.

Mites (*Raoiella indica*, *Oligonychus indicus*)

Mites are commonly found in arecanut gardens (February to March) but only occasionally under prolonged dry weather conditions, it poses serious problems. Two types of mites namely the red mite, *Raoiella indica*, and the white mite, *Oligonychus indicus* are found to infest the areca palm. Palms and seedlings grown under poor irrigated and exposed conditions are highly susceptible to mite attack. On pulling the leaves of young palms, red or white colour adheres to the fingers is a confirmation of red or white mites. Mites attack both seedlings and adult palms. They infest the lower surface of leaves by living in a thin web and suck sap and leaves turn yellowish-brown and dry up. Reddening of leaves due to mite infestation is common. The tender fruits are also attacked, causing malformation and shedding.

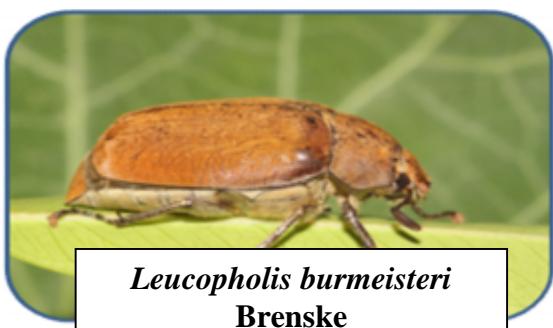


Control Measures

Grow banana as shade crop in young gardens or provide shade with coconut or areca leaves. Avoid transportation of infested seedlings from one place to other places. Sufficient irrigation should be given in summer months. Removal of heavily infested and dried leaves and burning helps in eradicating the source of infection. Smear cowdung slurry on leaves with the help of broomsticks. Spraying under surfaces of leaves and crown with Spinosad (0.5ml/Litre) or bufrofezin (1ml/litre) or 5% NSKE or neem oil (30-40ml/litre) or Dicofol (2 ml/litre) or Rogor (1.5 ml/litre) is effective. Repeat spraying at an interval of 15-20 days

Root grub (*Leucopholis lepidophora*, *Leucopholis coneophora* and *Leucopholis burmeisteri*)

Root grubs or white grubs are serious pests of areca nut palms growing in paddy fields. The grub has a characteristic 'U' shaped soft body with brown hairy legs. They feed voraciously on tender roots and later on older roots. The entire bole region is damaged in severe case of infestation. The grubs attack and feed on roots of both young and old palms. Due to root feeding, the leaves turn pale-yellow. Infested palms show a sickly appearance, tapering of stem, reduction in intermodal length and yield is reduced. As a result of the pest attack, the leaves turn yellow and fruits drop. Since the roots are eaten away, the palms become unsteady and succumb easily to wind.



Control Measures

Keep the garden clean, well-drained and free of weeds which reduce its attack. Collect and destroy adult beetles by digging (forking) the soil. Application of organic amendments and anti-feedants (neem, pongamia and oilcake @250g/palm) reduces the infestation.

Soil application of phorate 20g per palm around the plant twice a year, before onset of southeast monsoon (May) and after the monsoon (Sep-October)

In severely infected gardens, the soil should be drenched with eco-friendly insecticides. Loosen the soil around the base of the palm to a depth of 10-15 cm and drench with chlorpyriphos (3-5ml/litre) suspension twice, in May and September. Repeat the application for 2 or 3 years for complete eradication of the pest.

Pentatomid bug (*Haplyomorpha marmoreal*)

The adult and the young bugs suck sap from the endosperm of tender nuts, causing premature shedding during April-May. The dropped nuts have one or more pin prick-like marks on the surface. The adults are bronze coloured with brown spots and in young stages they are black with white spot on the leg.



Control Measures

When tender nuts are not available, the insect migrates to other hosts like cowpea and bitter guard. Therefore these crops should be closely watched and the bug when noticed should be mechanically removed and destroyed. One round of spray with chlorpyrifos (3ml/litre) or monocrotophos (1.5ml/litre) or Endosulfan (2ml/litre) on the bunches is effective.

Inflorescence caterpillar (*Tirathaba mundella* and *Batachedra* sp.)

This is a lepidopteran insect, where the caterpillars feed on the inflorescences (tender female flowers) and rachillae. Incidence of the pest is severe when the intermittent rainfall coincides with hot sun (May-July). Presence of small holes with frass with oozing and drying on the spate is the common symptom. Caterpillars web the rachis of inflorescence and feed on the flowers which affect pollination. As a result of this yellowing of spadices, rotting of inflorescence in spathe with delayed opening and less number of nuts is well exhibited



Control Measures

As a preventive method force open the suspected inflorescence out of the enclosing spathe and spray chlorpyrifos (2ml/litre) or malathion (2 ml/ litre). Control slugs, which predispose inflorescence to the attack of caterpillar, by using bait of metaldehyde

Arecanut Diseases

Arecanut (*Areca catechu* Linn family arecaceae) is an economically important plantation crop in India. It is widely grown in Karnataka, Kerala and Assams. In Karnataka, this crop is being cultivated in coastal (South Canara, North Canara and Udupi district), Malnad (Shimoga, Chikmagalur and Hassan), Maidan (Davanagere, Chitradurga, Tumkur and Mysore). The productivity of this palms is affected by number of diseases and nutritional disorders depending upon the climatic conditions prevailing. Since the crop is cultivated in valleys, scopes, low lands and plain lands which have different types of soils. About 20 diseases have been reported causing various degrees of damage to the palm. Among the diseases reported on arecanut, Fruit rot, (Kola roga), bud rot, crown rot, Yellow leaf disease, Hidimundige, (disorders), foot rot (Anabe roga), Inflorescence die back, Bacterial leaf stripe and nut splitting (disorder) are important. In this chapter important diseases, identifications of symptoms and their management through integrated practices has been given in this chapter for the benefit of arecanut growers.

Bacterial Leaf Stripe:

This is caused by *Xanthomonas campestris* pv arecae. The occurrence of this disease is more prevalent in maidan areas of Shimoga, Davanagere, Chitradurga and Tumkur Districts of Karnataka States in endemic forms.

Symptoms:-

Small 0.5-1 cm size water soaked lesions on the lamina. Margin of the lesion becomes wavy due to lateral spread. The corresponding lower surface of the lamina will be harboured by bacteria which is creamy white in the early stage but turns to grey or yellowish later. Infection cause partial or complete blighting of leaf. Eventually bud rot symptoms appear. Young palms (2-5 years) may die in severe cases.



Management:-

Combined spray of streptocycline/tetracycline at the rate of 0.5 gm/l of water 0.5g and copper oxychloride @ 2 of water is recommended. Spraying has to be done at fortnightly intervals.

Band/Hidimundige:-

Hidimundige / Band is a physiological disorder of Arecanut palm reported as a major problem in plain areas particularly Davangere, Chitradurga and Shimoga Districts. This disorder occur in gardens where poor management of soil, water and nutrients. It is found to be severe in ill drained clayey soils with poor aeration and in low lying areas. The term Band means barren in Marathi, as the diseased palm ceases to produce fruits. In Karnataka the disease is known as 'Hidimundige'. The disease causes gradual but considerable monetary loss to the growers. Crops loss due to this disease varies from 5 to 25% or more.



Symptoms :-

The first visible symptoms are the reduction in leaf size which turns brittle and crinkled with wavy margins. As the disease advances, there is reduction in inter nodal length, formation of small bunches, and tapering of stem. The crown shows rosette shape due to failure of natural

opening of leaves. The bunches becomes small and malformed. Roots are poorly developed crinkle and brittle. Histological studies indicated that reduce number of xylem and phloem vessels and besides increase of parachymatous in Hidimundige affected palms.

Management:-

- ❖ Provision of drainage channels once in two rows (1 1/2' depth with 1' width). Around the garden provision of 2 1/2' to 3' depth and 2' width channel is required.
- ❖ Application of organic manure 25 kg / palm and fertilizers at 100:40:140gm NPK per palm per year. For proper aeration sand application is to be done periodically.
- ❖ Minimize damage of roots during plowing.
- ❖ Avoid tank silt application
- ❖ Avoid deep plowing with tractor
- ❖ Cultivation of intercrops like Cocoa and Banana
- ❖ Use of local varieties like Tarikere and Bheemasamudra in the affected gardens for replantation.
- ❖ Follow plant protection to control sucking pests.

Bud rot:-

Bud rot is one of the fatal disease of arecanut. The pathogen *phytophthora arecae* affected the spindle of the areca palm causing rotting of the growing bud, which eventually kills the palm. The disease was recorded in a severe form in the heavy rainfall tracts of Karnataka. Though the disease generally occurs in monsoon season, the fresh infection during November onwards becomes severe during succeeding months. The crops loss due to this disease was 1 per cent or more.



Symptoms:-

Yellowing of tender leaf which later changes to brown. Spindle can be drawn out of the crown with a slight pull in advanced stages. Infection spreads to outer whorl of leaves leading to their yellowing, drooping and shedding. Diseased palm emits an bad smell.

Management:-

Remove the affected portion by making longitudinal side slit and the remaining healthy tissues treated with Bordeaux paste (10%). As a prophylactic measure drench the crown of surrounding palms with 1% Bordeaux mixture.

Inflorescence die-back and Button shedding:-



Die-back of inflorescence is due to the association of a fungal pathogen *colletotrichum gloeosporoides* and other secondary micro-organisms. The pathogen is air- borne in nature and spreads through wind to the neighboring healthy inflorescence. This problem causes low fruit set in arecanut. About 60% of the palms in the states of Karnataka and Kerala are infected by this

disease causing severe shedding of buttons. No systematic survey has been conducted to assess the crop loss caused by this disease.

Symptoms:-

Yellowing and drying of the rachis from the tip towards the base followed by shedding of female flower (buttons). This disease is more severe during February to May months.

Management:-

Removal and burning of affected inflorescence helps to reduce the load of inoculum's in the field. For the effective management of the disease spraying with Dithane Z78 or Dithene M-45 @ per litre of water is to be done during the months of February and March months. First spray at the time of opening of female flowers and the second 20-25 days thereafter.

Koleroga or Mahali



Koleroga is caused by *phytophthora arecaeae* / *phytophthora meadi* and is most dreaded disease of arecanut. It occurs in all the arecanut growing regions receiving heavy rain fall. However it is found to be epidemic in malnad and coastal districts of Karnataka

Symptoms:-

The first symptom is appearance of water soaked lesions near the calyx. Later these lesions spread over parts giving the nut a dark green colour. Infection causes nut shedding. The fallen nuts soon develop whitish mycelial mass all over the surface. Nuts of all ages attack if unchecked. Some times the affected nuts may not shed and remain mummified in the bunches. Such type of infection is called dry mahali.

Management:-

Provision of drainage, removal of branches of inter crops like Cocoa, Clove, Nut mug, Pepper and Forest tries, all around garden before onset of monsoon for proper aeration. Supplement of lime based on soil test 15 days before fertilizer application to neutralize the soil PH. Spraying with 1% Bordeaux mixture immediately after the first monsoon showers and the second round of spray after 40-45 days. Spraying operations are to be undertaken on clear sunny days. Diseased nuts and bunches are to be destroyed to reduce the inoculum. Polythene covering (125-200 gauge 24 x 30 inches) can as well substitute the traditional method of spraying Bordeaux mixture for effective management of Kola roga in arecanut.

Nut splitting:

Nut splitting is considered to be a physiological disorder rather than a pathological disease. The disease characterized by the cracking of fruits known as 'anduadakke roga' in Kannada. This abnormality is seen in patches in individual gardens and are common in young palms during winter season. The split of nuts drop and infection of the exposed kernel, renders them useless. The splitting is due to excess flow of cells in to the inflorescence. In well nourished garden this problem is very severe.



Symptoms:

Premature yellowing of nuts followed by the cracking of fruits. Cracks develop near the perianth end or the base or at both sides. Kernel also at times exhibit splitting. Potassium deficiency is also a probable cause of this melody.

Management:

Checking excess flow of cell sap by making severe deep wound at the base of spadix. Improvement of drainage in gardens with high water table will minimize the disease. Further spraying of Borax 0.2% in the early stage of disease also reduces the splitting.

Sun Scorch (Stem breaking)

In many parts of Malnad areas like Shimoga, Chikmagalur, Hassan Dakshina Kannada district, the areca growers were reporting breakage of stems in the upper half during heavy winds. Continued scorching followed by fungal infection weaken the stem and cause its breaking during strong winds. The side of the stem subjected to wide fluctuations in temperature is more prone to sun scorch.



Symptoms:

Symptoms appear on the exposed (South West sun) portions of the stem as golden yellow patches. Fissures develop at these patches later. Further colonization by saprophytic organisms and insects cause decay of the stem and such palms breaks during heavy wind.

Management:

Raising rapidly growing shade trees Eucalyptus, Casuarina, Silveroak and Teak etc, on the south-western side of the garden. Tying the trunk with areca leaf sheath/banana leaves growing of pepper reduces the scorching effect. Palms with longitudinal fissures are to be reinforced with split areca stem. Adoption of proper alignment while planting will also greatly minimize the damage due to sun scorch. Smearing the lime paste to exposed parts during winter months. Young palms are more prone to scorching.

Yellow leaf disease

Association of Mycoplasma like organism (phytoplasma) causing Yellow Leaf Disease is a major disease of arecanut. It has spread to most of the areca growing districts of Kerala and Karnataka (Koppa, Shringeri Taluks in Chikmagalur District and Sampaje Area in Dakshina Kannada District). The disease occurs in all types of soil and spreads rapidly. Reduction in yield up to 50% within a period of 3 years after the onset of the disease has been observed.

Symptoms:

Yellowing of leaf lamina interspersed with green stripes. Necrosis develops in advanced stages. Reduction in size of the crown, tapering of stem, gradual reduction in yield and dark brown coloration of the kernel. Roots are brittle and shows rotting.



Management:

- ❖ Removal of dead palms
- ❖ Grow cover crops in the garden
- ❖ Improvement of physical condition of the soil by deep digging and adding organic matter 12kg / palm besides recommended in organic fertilizers. (100:40:140 gms NPK / palm / year).
- ❖ In heavy sticky soil application of Gypsum at 500 kg/ha is required.
- ❖ Adequate drainage should be provided to avoid water stagnation.
- ❖ Plant protection measures should be adopted to control koleroga, anabe roga, budrot, spindle bug and mite infestation.
- ❖ Sun scorching of the stem should be avoided by covering with a arecanut leaves or painting with lime slurry.
- ❖ Providing irrigation during summer months.

Yellow leaf spot

Seedlings exposed to the sun are susceptible to this disease. The disease is severe during summer months and continues infect seedlings until the onset of rains.



Symptoms:

Small brown spots on the lamina which later coalesce to form large blighted areas. Severely affected palms exhibit shredding, drying and drooping of leaves.

Management:

Removal and destruction of severely affected leaf to minimize inoculum. Spraying with Dithane M45 @ 3g/l of water or foltaf @ 2g/l or Bavistin 0.05% monthly from Jun-Aug.

Anabe roga / Foot Rot:-

This disease is caused by fungus *Ganoderma lucidum*, it is more prevalent in neglected gardens causing 5-10% loss.



Symptoms:-

The initial visible symptoms is yellowing of outer whorl leaves which gradually extend to inner whorls followed by wilting and drooping. The development of inflorescence and nuts are arrested. Weakened crown topples over and leaving bare trunk. All around the base of the palm, brownish patches appear which exude a brown liquid. The growth of Anabe like structures are observed at the base of the palm in advanced stages. Eventually the plant dies. The infection extends to roots and gets discolored, brittle and dry.

Management:-

- ❖ Removal and destruction of the stumps along with roots.

- ❖ Isolate affected palms by digging trenches 60cm deep and 30cm wide around away from the base and drench with captan (0.3%) or calixcin (0.1%) or copper oxychloride at rate of 0.3%, 3 times a year at 4 months interval for 2 years.
- ❖ Discourage growing collateral hosts of fungus such as *Delonix regia*, *Pongamia*, *glabra* and *Tamarind indica* species.
- ❖ Apply 2 kg neemcake/ palm with 100gms *Traicoderma harzianum*
- ❖ Apply recommended dose of fertilizers at 100:40:140 gms / palm/year
- ❖ Avoid flood irrigation and water flowing from infected palms to healthy palms

Leaf spot:- (*Pestalotia*, *Phylosticta* and *Colletotrichum gloeosporioides*)

The leaf spot diseases occurs on older leaves of the crown young plants from nursery to 10 years age are more susceptible.

Symptoms:-

The disease appears during South West Monsoon. In marshy and low lying areas in the garden the disease is found to be severe. Small brown to dark brown or black round spots are seen in the lamina. In severe cases this disease causes drooping, necrosis and death of leaves in seedlings as well as adult plants.



Management:-

Removal of dead leaves is to be done, as prophylactic measure to reduce the spread of inoculum. Spraying of copper oxychloride at the rate of 0.3% or indofil m-45 at 0.3% or Bordeaux mixture at 0.1% is found effective.

Harvesting and Processing of Arecanut

Arecanut is a tropical plantation crop cultivated primarily for its kernel. This kernel is obtained from its fruit. Below you can see the raw fruits and the final arecanut.



Raw fruits



Raw kernels



Final arecanut

Arecanut plant starts yielding from 7th year in malnad and coastal belt and continue till it is of age 40. After that, it becomes uneconomical to maintain it. In maidan area where the soils are fertile and plenty of sunshine is available arecanut starts bearing from 4-5 years of age. But the economic life of the garden is less compared to coastal and malnad belt. As the trees grow older, a seedling would be planted adjacent to the old trees to make the **farm sustainable** in malnad area.

The harvesting season starts usually from August – December in maidan belt and from October to January in Malnad and coastal belt in three phases. The dried arecanut is non perishable agriculture product and it can be stored for any length of the time.

Processing steps:

Step1: Getting ready for harvest

Day starts at around 8:00 am in the morning from where all the tools along with the people head to the farm identified for harvesting. The preparation step for this are many. The following should have been finished before this day.

1. Fix the day and the farm for harvesting
2. Inform the time and the place where the people have to come. The most important being the climber, catcher and the transporter along with the ground staff to carry.
3. Inform all the people who can do the arecanut cutting job.

Please remember this work needs highly skilled people who know how to peal arecanut.

Keep in mind that the arecanut harvesting and processing is a complete people intensive work. It is difficult to be a one man show for this venture. It is a complete team work.

4. Inform the person who knows how to boil and sun dry the arecanut.

Below you can see a typical day where the people are starting from the farm owners' place along with the tools.



Heading towards the farm

Step 2: Harvesting the fruits from the tree

A. Tender nut processing

Arecanut is harvested in 3-4 harvesting period in a harvesting season at an interval of 30 days. The stage of harvesting depends upon the end product which is going to be obtained after processing. For preparation of red arecanut (tender nut processing) the nuts are harvested at 7-8 months maturity. During the harvest season, the ripened are mature fruits have to be harvested. Minimum two people with required skills are necessary to accomplish this. One professional tree climber with experience of plucking the fruits and another person who uses gunny bag or a long rope to catch / lower the bunch from the tree. Before the tree climber decides to pluck a bunch he plucks only one/two fruits and indicates the other person on ground to check the maturity level. The catcher checks the fruit and indicates the plucker whether to go ahead or not.



Climber with tools-A hard working man



Climber leg tools



Preparing to climb



Professional climber



Climbing to pluck



Catcher

Step3: Separating the fruits from the bunches

Once the bunches are plucked from the tree, it has to be separated from the rachis to get the individual fruits. This can be done simultaneously in the garden when the plucking process is going on. As the garden will be full of trees, unless there is a big enough space it'll be done on a rather flat place in the threshing yard / processing shed.



Women working at a farm



Farm owner joining the group for farm work



Separating fruits from the bunches

Step4: Storing and Transporting

Once the harvesting is completed it has to be transported safely to the home. During one full day of harvesting in a typical farm of about 1 acre, you can get the yield of 14-15 gunny bags of green nuts. The capacity of each gunny bag is 60 kgs. So, depending on the maturity of the nuts you may expect around 800-900 kgs of raw arecanut per acre. The normal process in the villages is to transport using head load/ bullock cart/ power tiller or tractor. If the quantity is more in the range of 30-40 gunny bags then the truck would be used for transporting purpose.



Harvested arecanut fruits from farm - Ready for peeling

Step5: Dehusking of raw nuts to get the Kernel

One of the most important activities in the entire arecanut processing is this step. The raw fruit has to be peeled in order to get the kernel. This has to be done within a day or two after harvesting. Otherwise, the cutting will not be easy at all. Since it is a heavy and intensive manual work, you need a minimum of 7-8 people working for an entire day to peel the arecanut raw fruits of 14-15 gunny bags (800-900 kgs). But, I still feel the amount they get per day is very less (between Rs.150-200).

Arecanut dehusking work can also be carried out using dehusking machines of different capacity in view of scarcity of skilled laborers. Now days dehusking machines are available in different models starting from dehusking capacity of 30 to 50 kg / hour to 225 to 275 kg/hour. 2-3 peoples are needed to work with the dehusking machines. It is observed that the quality of nuts was comparably inferior when compared to manually dehusked nuts.



Pealing work



Highly skilled and dangerous work - Peeling arecanut to get the kernel



Raw arecanut fruits and kernel side by side

Step6: Boiling the kernel

Immediately after dehusking, the raw nuts have to be boiled with high temperature for a minimum of 3-4 hrs. For efficiency purposes, two huge copper vessels of capacity of 500 to 600 litres are being used as seen in the below picture. The arecanut kernel has to be filled in to the vessel mixing with sufficient water, along with the extract of previous boiling. This process gives attractive reddish colour to the processed nuts.



Ready for boiling



Preparation for boiling



Preparation under way



Precipitate to be used during boiling process



Traditional boiler for arecanut



Boiler filled with raw kernels

Step7: Sun drying the boiled kernel

After boiling the arecanut kernel has to be sun dried for about 4 to 7 days. This is the last step of arecanut processing. In malnad area the boiled nuts are sun dried on a pendal erected for the purpose in the threshing yard to height of 10-12' using arecanut stems on bamboo mats. Were as in maidan area the bamboo mats are placed on the ground and the nuts are dried. Recently metallic fabricated trays of 6' x 3' size are also used for drying purpose. Artificial drying using the fabricated arecanut dryers are also used for drying of arecanut when adequate sun light is not available. While sun drying is in progress the nuts are heaped every evening and covered with polythene sheets or arecanut dried leaf sheath and the nuts are again uniformly spread on the bamboo mats next day morning. Once the drying process is over, it can be packed in and kept for any number of days before selling it in the retail market. For every 100 kgs of raw arecanut fruits, you can expect the final dried arecanut in the range of 13-15 kgs.

Arecanut Rectangular Copper Boiler



Arecanut Drying Tray with Wooden Frame (6' x 3')



Fruit separator from the bunch





Boiling is over



Taking out the boiled kernels



Ranganna on the way



Spreading the boiled kernels



Another view of sun drying



Sun drying in maidan belt



Ready for sun drying



See the difference between the dried and undried

8. Grading of processed nuts

In malnad and maidan belt grading of arecanut is invariably carried out by skilled graders manually to get higher market rates. The various grades made in malnad includes, Hasa (Battlu), Bette, Unde, Chooru, Gorabalu, Chikni etc. After grading the processing nuts are packed in clean gunny bags holding about 60 to 70 kg of processed nuts.

B. Processing of ripe nuts (Chali production)

For production of chali the ripened nuts are harvested from the tree. After harvesting the fruits are separated from the bunches and they are sun dried for 40 to 45 days on a clean cement/ tiled floor or a short pendal erected near the threshing yard for drying of ripe nuts. During drying process the fruits are turned over periodically to facilitate uniform drying.

Arecanut Drying in Maidan Belt



Arecanut Drying in Malnad Belt



Arecanut Dryer (150 kg capacity dry nuts)



Size: 68' x 119' x 69' L x B x H

Source of Fuel: Arecanut husk, Coconut husk, fire wood

**Areca nut Research Centre,
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ARECA CULTIVATION WORLD

Areca nut is cultivated in an area of 4.37 lakh ha with a production of 5.52 lakh tones with a productivity of 12.63 kg/ha during 1995. The area and production has increased to 7.02 lakh ha and 8.54 lakh tones during the year 2006. There has been 37% increase in area and 35% increase in production during the past ten years (Table-1). However there is not much increase in the productivity of the crop.

Table-1 WORLD AREA, PRODUCTION AND PRODUCTIVITY

YEAR	AREA('000ha)	PRODUCTION ('000 tonnes)	PRODUCTIVITY (kg/ha)
1995	437.32	552.46	1263
1996	451.37	566.24	1254
1997	456.01	562.21	1233
1998	468.32	593.20	1267
1999	516.93	645.15	1248
2000	549.20	646.48	1177
2001	596.58	707.86	1187
2002	628.45	740.09	1178
2003	653.97	762.69	1166
2004	674.34	794.52	1178
2005	691.3	819.76	1186
2006	702.89	854.22	1215

DISTRIBUTION OF ARECANUT CULTIVATION IN THE WORLD

Areca nut is cultivated in eleven countries of the world, India, Indonesia, China, Bangladesh, Myan mar, Thailand, Malaysia, Maldives, Nepal, Srilanka and Kenya. The Area has increased from 5.49 lakh ha during 2000 to 7.02 lakh ha during 2006 at the same time the production has increased from 6.46 lakh tones to 8.54 lakh tones from 2002-2006. India accounts for 55% of the area and 56% of world production, China accounts for 7% of the area and 18% of the production, Indonesiya accounts for 18% of area and 6% of production, Bangladesh accounts for 11% of the area and 6% of the production, Myanmar accounts for 5% of the area and 7% of the production, other countries accounts for 4% of the area and 7% of the production (Table-2). Nepal has started cultivation of arecanut recently

Table-2 COUNTRYWISE AREA(000ha), PRODUCTION(000 tonnes) AND PRODUCTIVITY(kg/ha)

COUNTRY	2000			2001			2002			2003			2004			2005			2006		
	Area	Prodn.	Pdty																		
India	289.00	334.40	1157	315.20	373.10	1184	340.90	403.10	1182	354.26	415.88	1174	365.04	439.15	1203	374.06	456.34	1220	381.10	483.14	1268
Indonesia	82.60	37.60	455	102.02	45.59	447	107.20	42.31	395	118.78	46.80	394	115.83	44.00	380	122.71	50.18	409	124.96	51.88	415
China	51.62	166.98	3235	51.03	165.08	3235	51.20	162.25	3169	50.79	159.58	3142	50.06	143.37	2864	50.10	144.00	2874	52.00	150.00	2885
Bangladesh	77.00	45.00	584	77.80	47.00	604	77.30	51.00	660	77.30	55.00	712	77.70	55.00	708	77.70	55.00	708	78.00	55.00	705
Myanmar	33.95	39.10	1152	34.98	51.46	1471	35.00	55.00	1571	36.00	57.00	1583	36.00	57.00	1583	36.00	57.00	1583	36.00	57.00	1583
Thailand	13.00	20.00	1538	14.00	23.00	1643	16.00	25.00	1563	16.00	27.00	1688	16.00	27.00	1688	16.00	27.00	1688	16.00	27.00	1688
Malaysia	2.00	3.30	1650	1.50	2.50	1667	0.80	1.30	1625	0.80	1.30	1625	0.80	1.30	1625	0.80	1.30	1625	0.80	1.30	1625
Maldives	0.03	0.01	467	0.05	0.04	740	0.05	0.04	740	0.05	0.04	745	0.05	0.01	216	0.05	0.05	1020	0.04	0.33	1235
Nepal													1.97	3.77	1909	2.00	3.82	1909	2.02	3.86	1909
Sri Lanka													10.88	23.83	2190	11.72	24.99	2132	11.97	24.61	2056
Kenya		0.09			0.09			0.09			0.09			0.09			0.09			0.09	
WORLD	549.20	646.48	1177	596.58	707.86	1187	628.45	740.09	1178	653.97	762.69	1166	674.34	794.52	1178	691.13	819.76	1186	702.89	854.22	1215

Table-3 STATEWISE AREA AND PRODUCTION OF ARECANUT IN INDIA (AREA :'000 HECTARES, PRODUCTION :'000 TONNES (Area:'000ha,Production:'000 tonnes, Yield:kg/ha)

ARECANUT PRODUCTION IN INDIA

Arecanut is being cultivated in 14 States in India with an area of 3.88 lakh ha with a production of 4.82 lakh tones and a productivity of 1244 kg/ha. Out of 14 States cultivating arecanut Karnataka States stands first with an area of 1.68 lakh ha with a production of 2.24 lakh tones followed by Kerala with an area of 1.01 lakh ha with a production of 1.17 lakh tones. North Eastern State Assam occupies the third position with an area of 0.69 lakh ha with a production of 0.62 lakh tones. Karnataka, Kerala and Assam put together account for 87% of the Arecanut area in the country and 83% to the total Indian production. The Indian production of the arecanut has increased from 3.33 lakh tones during 1997-98 to 4.82 lakh tones in the year 2008-09. Similarly the total area under arecanut in the country has increased from 2.73 lakh ha during 1997-98 to 3.88 lakh ha in the year 2008-09. So there is a increase of 29% in area and 30% in production during the past ten years (Table-3).

STATE	1997-98		1998-99			1999-2000			2000-01			2001-02		
	AREA	PRODN.	AREA	PRODN.	YIELD	AREA	PRODN	YIELD	AREA	PRODN	YIELD	AREA	PRODN	YIELD
ANDRA PRADESH	0.2	0.5	0.2	0.3	1500	0.2	0.2	1000	0.3	0.7	2333	0.3	0.4	1333
ASSAM	73.8	56.7	74.5	55.4	744	73.5	52.9	720	73.2	68.3	933	73.2	69.7	952
GOA	1.5	1.8	1.5	1.8	1200	1.6	1.9	1188	1.6	2.5	1563	1.6	3.5	2188
KARNATAKA	93.1	133.3	98	134.8	1376	107.4	147.1	1370	119.1	162.7	1366	136.1	182.8	1343
KERALA	76.1	94	73.6	68.5	931	76.1	80.1	1053	87.4	87.9	1006	93.2	84.7	909
MAHARASTRA	1.9	7.5	1.9	7.5	3947	2.1	4.2	2000	2.2	4.4	2000	2	7	3500
MEGHALAYA	9.5	12.1	9.6	11.6	1208	9.7	12.6	1299	11.2	13.7	1223	11.1	14.1	1270
MIZORAM	0.7	0.1	1.2	0.2	167	0.9	0.6	667	1	1.8	1800	1.3	5.6	4308
NAGALAND												0.1	1.3	13000
TAMILNADU	2.8	5.7	2.8	6.3	2250	3.3	10.6	3212	3.7	4.8	1297	4.8	4.8	1000
TRIPURA	2.3	4.2	2.3	4.2	1826	2.4	4.9	2042	3.2	6.8	2125	3.4	6.9	2029
WEST BENGAL	8.1	12.4	8.2	13.7	1671	7.7	13.1	1701	7.8	12.2	1564	9.3	14.9	1602
ANDAMAN NICOBAR	3.6	5.2	3.6	5.5	1528	4	6.1	1525	4.4	7.2	1636	4.4	7.3	1659
PONDICHERRY	0.1	Neg.	0.1	Neg.		0.1	0.1	1000	0.1	0.1	1000	0.1	0.1	1000
ALL INDIA	273.6	333.5	277.5	309.8	1116	289	334.4	1157	315.2	373.1	1184	340.9	403.1	1182

Table-3 continued

2002-03			2003-04			2004-05			2005-06			2006-07			2007-08			2008-09(Tentative)		
AREA	PRODN	YIELD	AREA	PRODN.	YIELD	AREA	PRODN.	YIELD												
0.3	0.2	667	0.3	0.2	667	0.3	0.1	333	0.3	0.2	667	0.0	0.0	690	0.3	0.2	754	0.25	0.2	754
73.7	51.6	700	74	69	932	74.0	69.0	932	71.2	66.8	938	71.0	65.0	915	70.3	68.1	969	69.97	62.7	896
1.6	2.5	1563	1.6	2.7	1688	1.6	2.5	1563	1.6	2.6	1625	1.7	2.6	1529	1.7	2.6	1529	1.85	2.8	1503
144.1	192.8	1338	148.9	198.9	1335	153.0	203.9	1333	161.6	215.7	1335	168.4	224.0	1333	174.4	231.7	1329	168.00	224.0	1333
97.5	107.3	1101	102.5	105.5	1029	107.6	110.3	1026	108.6	119.3	1099	102.1	110.0	1077	99.8	114.7	1149	101.73	116.9	1149
2	4	2000	2	5	2500	2.0	5.0	2500	2.0	5	2500	2.3	3.6	1565	2.2	3.6	1626	2.20	3.6	1626
11.2	14.2	1268	11.2	14.2	1268	11.2	14.2	1261	11.5	15.5	1350	12.0	16.6	1383	12.1	16.5	1361	12.36	17.1	1384
1.7	5.7	3353	2	5.3	2650	2.0	5.3	2650	2.0	5.3	2650	2.0	5.3	2650	2.0	5.3	2650	6.58	8.2	1248
0.2	1.3	6500	0.2	1.3	6500	0.2	1.3	6500	0.2	1.3	6500	0.2	1.3	6500	0.2	1.3	6500	0.20	1.3	6500
5	5.3	1060	5.2	4.9	942	5.1	7.9	1549	4.8	10.3	2146	5.5	11.9	2164	5.6	11.7	2114	5.03	10.4	2067
3.4	6.9	2029	3.4	6.9	2029	3.4	6.9	2029	3.4	6.9	2029	3.4	6.9	2029	3.4	6.9	2029	4.43	8.4	1886
9.1	16.6	1824	9.2	18.5	2011	9.4	25.3	2690	9.4	29.3	3117	24.4	106.1	4348	9.0	22.0	2444	11.39	21.2	1857
4.4	7.4	1682	4.4	6.7	1523	4.4	4.8	1091	4.4	4.8	1091	4.1	5.8	1415	4.1	5.7	1400	4.10	6.0	1463
0.1	0.1	1000	0.1	0.1	1000	0.1	0.1	1000	0.1	0.1	1000	0.1	0.1	1000	0.1	0.1	1306	0.06	0.1	1306
354.3	415.9	1174	365	439.2	1203	374.1	456.3	1220	381.1	483.1	1268	396.8	559.2	1409	385.0	490.3	1274	388.15	482.7	1244

ARECANUT CULTIVATION IN KARNATAKA

Arecanut is cultivated in 23 Districts out of 29 Districts of the State accounting for 40% the area of the crop and 50% of the production in the country. There has been a tremendous increase in the area in recent years (nearly 45% in during past 5 years period). Easy cultivation practices assured economic returns and good market price has contributed to tremendous increase in the area of the crop. Apart from traditional arecanut growing districts located in malnad, coastal and maidan belts arecanut is being cultivated at present in majority of the districts use in cannel water and underground water sources also. Shimoga district with an area of 29,150 ha stands first followed by Dakshina Kannada with an area of 27,209 ha and Davanagere district stands in third position with an area on 22,015 ha. In production Dakshina Kannada district stands first with a production of 48,540 tones followed by Shimoga (43,865 tones). Davanagere district occupies third place with a production of 21 thousand 206 tones. There has been tremendous increase in the area of crop in Davanagere, Shimoga, Thumkur, Chitradurga, Hassan Districts in recent years (Table-4) . In Chikmagalur District the area has increased from 13,000 ha in 1999-2000 to 16,000 ha in 2004-2005. The increase in area is more pronounced in maidan belt when compared to coastal and malnad belt.

Table-4 DISTRICTWISE AREA(HA) AND PRODUCTION(Tonnes) IN KARNATAKA

DISTRICT	1999-2000		2000-2001		2001-2002		2002-03		2003-04		2004-05	
	Area (ha)	PROD (tonnes)	AREA	PROD (tonnes)								
BAGALKOTE	4	6	4	6	4	6	6	0	6	8	2	3
BANGALORE-URBAN	81	113	81	113	81	113	49	69	216	302	233	326
BANGALORE-RURAL	500	699	514	719	1828	2557	1904	2663	1998	2795	1975	2763
BELGAUM									2	3	8	11
BELLARY	12	17	19	27	26	37	30	43	30	43	32	46
CHAMARAJNAGAR	174	124	329	234	279	198	279	198	309	219	309	219
CHIKMANGALUR	13506	15470	14186	16249	15796	18093	15910	18224	16347	18724	16616	19032
CHITRADURGA	8001	7707	9827	9466	12153	11707	13452	12958	14366	13838	14498	13965
DAKSHINA KANNADA	23602	42105	25447	45397	25578	45631	27070	48292	27092	48332	27209	48540
DAVANAGARE	13860	13351	14476	13944	19487	18771	20922	20154	21235	20455	22015	21206
DHARWAD	10	14	17	24	10	14	10	14	8	11	11	15
GADAG									2	3	3	4
HASSAN	1825	1783	1922	1878	2128	2079	3171	3098	3193	3120	3483	3403
HAVERI	239	334	360	503	507	708	721	1007	634	886	717	1002
KODAGU	1171	1638	1198	1676	1230	1721	1332	1863	1344	1880	1386	1939
KOLAR	111	155	86	120	81	113	72	101	67	94	54	76
MANDAYA	681	952	700	979	732	1023	804	1124	816	1141	879	1229
mysore	503	357	400	284	798	566	679	482	645	458	676	480
SHIMOGA	21105	31759	23927	36005	26359	39665	26725	40216	28039	42193	29150	43865
TUMKUR	8209	10069	10428	12791	12628	15490	14226	17450	15459	18962	16197	19867
UDUPI	3834	6840	4012	7157	4877	8700	4930	8795	4954	8838	5019	8954
UTTARAKANNADA	9998	13590	11160	15169	11483	15608	11824	16072	12177	16552	12287	16701
TOTAL	107426	147083	119093	162741	136065	182800	144116	192823	148939	198857	152759	203646