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ARECANUT

PACKAGE OF PRACTICES

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1. Introduction:

Arecanut palm *(Areca catechu* Linn.*)* is cultivated primarily for its kernel obtained from the fruit. The Kernel is used by the people all over India for chewing in tender, ripe or processed form. Arecanut is one of the important cash crops of India. Commercial cultivation of arecanut is done only in India, Bangladesh and Sri Lanka. However, it is grown as a stray crop in Indonesia and in some of the Pacific Ocean Islands. In India, about 90% of the area and 95% of the production are concentrated in the three states of Kerala, Karnataka and Assam as evident from the following data.

(1985 – 86)

States	Area (ha)	Production (Tonnes)
Assam	51,200	64,300
Karnataka	58,500	85,800
Kerala	56,800	50,300
Others	20,000	23,800
	1,86,500	2,24,200

On account of the various research and development efforts undertaken in the past three decades, arecanut production has now almost reached a level of self-sufficiency. Uses for arecanut other than chewing are negligible. Its export prospects are also very much limited. Therefore, the present policy is not to expand the area under arecanut, but to adopt intensive cultivation and take up replanting of the aged, unproductive gardens. Inter and mixed cropping in arecanut gardens is advocated to augment the income further in the existing arecanut gardens.

2. Climate and soil:

The arecanut palm is capable of growing under a variety of climatic and soil conditions. It grows well from almost sea level

up to an altitude of 1000 meters in areas receiving abundant and well distributed rainfall or under irrigated conditions. It is grown in a variety of soils such as laterite, red loam and alluvial soils. The soil should be deep and well drained without high water table.

3. Varieties:

Mangala VTL–3 is a variety released for cultivation. Sumangala VTL–11 and Sreemangala VTL–17 also have been recommended for release and for large scale cultivation in Dakshina Kannada district of Karnataka and Kasaragod and Cannanore districts of Kerala. There are a few cultivars in different localities known by the name of the place, where they are grown.

'South Kanara': It is largely grown in Dakshina Kannada district of Karnataka and Kasaragod district of Kerala. It is characterised by large sized nuts with uniform bearing and the average yield of ripe nuts is about 7 kg/palm/year. It is mainly used for making *chali*.

'Thirthahalli': It is grown extensively in *Malnad* area of Karnataka. Its yield is comparable to that of 'South Kanara', cultivar and nuts are preferred for tender nut processing.

'Sreevardhan': It is grown widely in the coastal Maharashtra. The nuts of this variety are oval in shape and the yield is comparable to 'South Kanara'. Because of the larger proportion of its endosperm it is tastier than other varieties. Because of the shape and marbled appearance of the kernel when cut, it fetches premium price in the market.

'Mangala' VTL–3: It has a number of desirable characters such as earliness in bearing, higher fruit set and higher yield (10 kg ripe nuts/palm/year) and quicker stabilisation of production. It is a semi tall variety with good chewing and marketing quality.

Sumangala VTL–11: A selection from Indonesia. Average yield is 17.5 kg/palm at the age of 10 years.

Sreemangala VTL–17: Selection from Singapore. Average yield is 15.63 kg/palm at the 10th year.

Mettupulayam: It is large grown in Tamilnadu.

Mohitnagar: This variety is largely grown in Eastern Region like West Bengal.

Kahikuchi: This variety is grown in North Eastern regions like Assam, Manipur, Mizoram, Tripura etc.

4. Selection and raising of planting material:

4·1. *Mother palm selection:* The importance of genetically superior planting material, particularly in a perennial crop like arecanut needs no emphasis. One of the established methods of selecting such genetically superior planting material is to select palms possessing characters of heritability. Of the many mother palm characters studied, age at first bearing and percentage of nut set were found to be correlated with yield and having high heritability. Therefore, collection of seednuts should be confined to palms which commence to bear early as well as to those which give a high percentage of fruit set. For selecting palms which commence to bear early, the plantation should be kept under regular observation from the beginning and early bearing palms marked out. Among the early bearing palms, only palms which give high yield and more than 50 percent fruit set are selected as mother palms. Collection of seednuts from the selected mother palms may be commenced after the yield of the palms is stabilised, which normaliy takes 4 to 5 years.

4·2. *Selection of seednuts:* From the selected mother palms only fully ripe nuts should be collected. All undersized and malformed nuts must be rejected. Heavier seednuts (above 35 g) within a bunch give higher percentage of germination and produce seedlings of better vigour than lighter ones.

4·3. *Nursery techniques:* The selected seednuts are sown soon after harvest 5 cm apart in sand beds under partial shade with their stalk ends pointing upwards. Sand is spread over the nuts just to cover them. The beds are to be watered daily. Germination commences in about 40 days after sowing and the sprouts can be transplanted to the second nursery when they are about three months old. At this stage the sprouts might have produced two to three leaves.

Secondary nursery beds of 150 cm width and of covenient length are prepared for transplanting the sprouts. If banana is used as shade crop it should be planted in advance at a spacing of 2·7 m x 2·7 m. The sprouts are transplanted at a spacing of 30 cm x 30 cm with the onset of monsoon. A basal dose of well decomposed cattle manure at the rate of 5 tonnes per hectare may be applied in the secondary nursery. Partial shade to the seedlings can also be provided during summer by 'pandal' or growing *Coccinia indica*. Crops such as banana and coccinia provide not only shade but also give higher returns to the grower. Care should be taken to drain the nursery beds during the monsoon and to irrigate them during the dry months. Weeding and mulching should be done periodically. Seednuts can also be sown in polythene bags (25 x 15 cm size, 150 gauge) after filling the bags with potting mixture containing 7 parts of loam or top soil, 3 parts of dried and powdered farm yard manure and 2 parts of sand, and then the seedlings raised.

4·4. *Selection of seedlings:* The seedlings will be ready for transplanting to the mainfield when they are 12 to 18 months old. Seedlings having 5 or more number of leaves should be selected. The height of seedlings at the time of planting has a negative correlation with the subsequent yield of the plant. Hence shorter seedlings are preferred. A simplified selection method to adjust to the practicability of the cultivator consists of selecting seedlings with maximum number of leaves and minimum height as per the formula, (No. of leaves $\times$40)—height=seedling index; seedlings with a high value should be selected to the extent practically feasible. Selected seedlings are removed with a ball of earth for transplanting. If the seedlings are raised in polythene bags, these can be straightway transported to any distance without much damage.

5. Establishing Plantation:

5·1. *Planting time:* The planting is done during May–June in well drained soils and during August–September in clay soils subject to water logging.

5·2. *Spacing and alignment:* Being very susceptible to sun-scorch, arecanut palms need adequate protection from

exposure to the south-western sun. Proper alignment of the palms in the plantation will minimise sun scorching of the stem. In the square system of planting at a spacing of 2·7 m x 2·7 m, the north-south line should be deflected at an angle of 35° towards west. The outermost row of plants on the southern and south-western sides can be protected by covering the exposed stem with areca leaves or leaf sheaths or by growing tall and quick growing shade trees.

5·3. *Planting:* Pits of 90 $\times$ 90 $\times$ 90 cm are dug at a spacing of 2·7 m $\times$ 2·7 m. The pits are filled with a mixture of top soil, powdered cow-dung and sand to a height of 50 to 60 cm from the bottom. The seedlings are planted in the centre of the pit, covered with soil to the collar level and pressed around. A shade crop of banana can be raised with advantage which, in addition to giving protection to seedlings from sun-scorch, also gives higher return.

5·4. *Manuring:* A steady and high yield will depend to a great extent on the availability of adequate supplies of plant nutrients in the soil throughout the life of the crop. In perennial crops like arecanut this problem requires special consideration since the crop will be in the field for several years. Since major arecanut growing areas are situated in regions of heavy rainfall, the soils are severely leached and eroded thus making them poor in plant nutrients.

Annual application of 100 g N, 40 g P_2O_5 and 140 g K_2O in the form of fertilizers and 12 kg each of green leaf and compost or cattle manure per bearing palm is recommended. Application of 150:60:210 g N, P_2O_5 and K_2O/palm/year in two split doses (February–March & September–October) is recommended for 'Mangala'.

Under rainfed conditions, half the quantity of fertilizers may be applied in April–May and the remaining quantity in September–October. Where the plantations are irrigated, the first dose of fertilizer is applied in February instead of April–May. Green leaf and compost can be applied in single dose in September–October. For young plants full dose of green leaf

and compost or cattle manure may be applied from the first year of planting itself, one-third of the recommended quantity of fertilizer in the first year, two-thirds in the second year and the full dose from the third year onwards. Manuring during September–October is done in basins around the palm dug to a depth of 15 to 20 cm and 0·75 to 1 m radius. The first dose of fertilizers may be broadcast around the base of each plant after weeding and mixed with the soil by light forking.

In many places arecanut is grown in acidic soils. In such places, application of lime corrects soil acidity, increases the availability of plant nutrients, reduces phosphorus fixation in the soil, enhances the microbiological activity and supplies calcium, an essential plant nutrient. The lime requirement of each soil may be determined separately and the required quantity of lime broadcast around the basins preferably during the dry months and worked in. For acidic soils Rock/Mussoorie rock phosphate is perferable.

5·5. *Irrigation and drainage:* The palms should be irrigated once in four to seven days depending on the soil type and climatic factors. In southern districts of Kerala where arecanut is grown mainly under rainfed conditions, irrigation along with manuring gives three times more yield than what is obtained by manuring alone. In West Coast where major area of arecanut gardens are irrigated, watering the gardens once in seven or eight days during November–December, once in six days during January–February and once in 3–5 days during March, April and May is recommended. In each irrigation, application of about 175 litres of water per palm is suggested. In gardens where there is shortage of water, for efficient water use and economisation of irrigation water, drip irrigation may be adopted. Application of organic mulches to the garden during summer months helps in conserving soil moisture and to reduce the soil temperatures. Adequate drainage should be provided during monsoon since the plants are unable to withstand waterlogging. Drainage channels should be 25 to 30 cm deeper than the bottom of the pits to drain excess water from plot.

5·6. *Cultural operations:* A light digging may be required when the monsoon ends in October–November to break up

any crust formed at the soil surface and to uproot weeds. Terracing will be required to prevent soil erosion on slopy lands. Weeding should be done periodically to keep the garden clean.

5·7. *Cover cropping:* Cover crops, in addition to supplying organic matter to the soil, prevent soil erosion. Leguminous crops are preferred to nonleguminous crops because of their ability to fix atmospheric nitrogen and enrich the soil. Of the different green manure cum cover crops tried, *Mimosa invisa* (thornless mimosa), *Stylosanthes gracilis* and *Calapogonium muconoides* have been found to be suitable for arecanut gardens. The optimum time for sowing of cover crops is the months of April–May when the pre-monsoon showers will reduce the competition for soil water between the cover crop and the arecanut. The green matter can be cut and applied to arecanut palms by October.

5·8. *Inter and mixed cropping:* Considering the long prebearing age of 5 to 8 years, the low income in the early period of bearing and the fluctuations in the market price of arecanut from year to year, it is worth to take up inter-cropping in arecanut gardens. The practice helps the arecanut growers to get additional income and to cover the risk of poor yields from arecanut resulting from unfavourable weather conditions and incidence of pests and diseases.

The choice of inter-crops depends on its ability to tolerate shade and to withstand the heavy dripping from arecanut palms during monsoon showers. Also, the subsidiary crops should not compete with arecanut for their nutrient requirements. The crops which can be grown successfully in arecanut gardens without loss of arecanut yields are banana, cacao, pepper, pineapple, betel vine, elephant foot yam, tapioca, dioscorea, sweet potato, arrow root, ginger, turmeric and guinea grass. Under high density cropping system, these crops may be simultaneously planted in the arecanut gardens so as to effectively utilize the soil, air space and incident sunlight continuously over a period of time for production of maximum biomass having economic value and diverse use and also maximum returns per unit area.

6. Plant Protection:

6·1. *Pests:* Arecanut palm is infested by many insects and non-insect pests. However, only a few of them are considered to be of major importance. They are the mites, spindle bug, root grub and inflorescence caterpillar. The crop loss is direct when the pest attack is on inflorescence or nuts. The pest attack on leaves, stem and roots causes indirect crop loss by affecting the general growth of the palm.

6·1·1. *Mites:* Two types of mites namely the red mite *(Raoiella indica* Hirst*)* and the white mite *(Oligonychus indicus* Hirst*)* are found to infest the areca palm. Palms and seedlings grown under poorly irrigated and exposed conditions are highly susceptible to mite attack. Adults and young ones of these mites are seen in colonies in the lower surface of leaves sucking up the sap. As a result of their feeding, the colour of the leaves turns yellow and presents a bronzed appearance. The leaves ultimately wither away causing severe damage.

The mites multiply during summer months. With the onset of monsoon showers their population declines. Many natural enemies are found in the field feeding on mites. When they are unable to control the pest, chemical control may be adopted. The pest can be effectively controlled by spraying the lower surface of leaves with dicofol (Kelthane) at a concentration of 2 ml/litre of water. Spraying with formothion (Anthio 25 EC) at 2 ml per litre of water or dimethoate (Rogor 30 EC) at 1·5 ml per litre of water also gives effective control of the pest. Spraying has to be repeated at an interval of 15 to 20 days if there is recurrence of pest.

In addition to the above mites, another species of orange coloured mite *(Dolichotetranychus sp.)* also attacks the arecanut fruits. They harbour inside the inner whorls of perianth of tender nuts and suck the sap. Their feeding activity causes nut shedding. This mite can be controlled by spraying the bunches with dimethoate (Rogor 30 EC) at a concentration of 1 ml per litre of water.

6·1·2. *Spindle Bug (Carvalhoia arecae* Miller and China*):* This is another serious pest which causes considerable damage

especially in south and central Kerala and in parts of Karnataka. The pest is found in colonies within the top most leaf axil at the base of the spindle. Both adults and young ones suck the sap from the tender spindle. As a result of attack, the spindles fail to unfurl completely, often get twisted and do not attain their normal size. The effected leaves show numerous linear dark brown necrotic patches. The necrotic patches later dry up and drop off in the wind forming shot holes on the lamina. Severe infestation results in loss of vigour of palms and consequent death. The population of the pest is more during monsoon and post monsoon periods. The young ones are pale yellowish green and the adults are red and black in colour.

Placement of 2 g phorate granules (Thimet 10 G) in perforated polybags in the inner most leaf axils of areca palms during April is an effective management practice for maintenance of areca gardens free of spindle bug infestation. The efficacy of the insecticide lasts for eight months. As new leaves emerge polybags are to be shifted to the innermost leaf axils.

6·1·3. *Root grub (Leucopholis burmeisteri* Brenske*):* Root grub or white grub is a serious pest of arecanut palm. The grub has a characteristic 'U' shaped soft body with brown hairy legs. They feed voraciously on tender roots first and later on older roots. The entire bole region is damaged in severe cases of infestation. As a result of the pest attack, the stem tapers, leave turn yellow and fruits drop. Since the roots are eaten away, the palm becomes unsteady and succumbs to wind. The grub is generally found in low lying areas with high water table or in gardens where water logging condition prevails during rainy seasons. Good drainage should, therefore be provided before any attempt is made in controlling the pest.

The grubs can be effectively controlled by application of soil insecticides. Phorate (Thimet 10 G) applied at the rate of 8 g per palm gives effective control of the pest. Application of chlordane 5% dust or BHC 5% dust or quinolphos (Ekalux 1·5% dust) at the rate of 120 kg/ha also gives effective control of the pest. The insecticide has to be applied twice a year, once in May before the onset of south-west monsoon and again in

September–October after the monsoon. The treatment must be repeated for 2–3 years continuously for getting a satisfactory control of the pest in severely infested gardens.

6·1·4. *Inflorescenes caterpillar (Tirathaba mundella* Walk*):* This pest is important because it attacks the inflorescence directly. The adult moths lay eggs in the injuries made on the spathes by slugs and earwigs. On hatching, the caterpillars gain entry into the inflorescence and feed on the flowers inside. They clump the inflorescence into a wet mass of frass with the silky threads formed by them and take shelter therein. Inflorescence infested by the pest can be located easily by an experienced person. The effected spadices do not open fully. The punctures made by the slugs at the base of spadices indicate the presence of caterpillars inside as frass extrudes through them. Such spadices should be forced open and sprayed with malathion 50% EC at the rate of 2 ml per litre of water. Slugs which are predisposing factors for the incidence of inflorescence caterpillar can be controlled effectively by using baits of metaldehyde.

6.1.5. *Tender nut drop:* In some gardens, tender nut drop is a serious problem during monsoon season. Most of the shed nuts show a few pin-prick like black puncture marks on the surface. The kernel in these nuts becomes discoloured to dark brown. This malady is caused by a Pentatomid bug *(Halyomorpha marmorea F)* which pierces the tendernut with its long proboscis and sucks the sap, resulting in the premature drop of the nut. The insect at young stage is black while the adult is pale bronze in colour.

Preliminary results show that the malady can be controlled with a spary of endosulfan 0.05% or Methyl parethion 0.05% or Fenvolarate 0.02% to the bunches one round just before the onset of monsoon and the second round 45 days thereafter. Since cowpea is an alternate host, care should be taken to keep this vegetable free of this pest.

6·2. *Disease:* Arecanut palm is affected by a number of diseases. Some of the diseases are seasonal while others occur throughout the year. The symptoms, management and control of diseases are discussed here.

6·2·1. *Koleroga or Mahali:* The disease is caused by a fungus *Phytophthora arecae* and is also known as fruit rot. It is widespread in occurrence in all the areca growing tracts causing economically losses usually as high as 80% or even total crop loss. The symptoms of the disease appear on the nut surface near the perianth as water-soaked lesions. Later these lesions spread over the other parts giving the nut a dark green colour. Infected nuts are shed, usually without perianth. High humidity alternating with bright sunshine and rain favour the disease. The fungus spreads mainly through rain splash and also through insects and wind.

Spraying with 1% Bordeaux mixture gives a satisfactory control of the disease. A minimum of two sprayings are required and first is recommended after the first monsoon showers and the second 40–45 days thereafter. If the monsoon prolongs, a third spraying is necessary. To ensure effective control of the disease, spraying operations are to be undertaken on clear sunny days. As a preventive measure, periodic collection of infected plant parts and their destruction by burning is essential to reduce the inoculum of the fungus and its further spread.

Preparation of 1% Bordeaux mixture: Dissolve 1 kg of Copper Sulphate in 50 litres of water and 1 kg of lime in 50 litres of water separately and mix just before spraying. If the quality of lime is inferior 1 kg of lime may not be sufficient to neutralise the copper sulphate. To test the excess copper in the Bordeaux mixture solution, dip a polished iron knife or nail into the solution. If copper is in excess a brownish coating will appear on the knife in which case add lime till such coating disappear.

Since Bordeaux mixture is a protective fungicide the entire surface of the nuts has to be covered fully. This could be achieved by applying the spray solution as a very fine spray.

6·2·2. *Bud Rot:* The disease is also caused by the same organism causing *Koleroga*. But here base of the spindle or heart leaf gets affected first. The fungus gains access to the host tissue through the space between the spindle and pitioles of the topmost leaf. Initially the affected spindle appears yellow

which later changes to brown and finally the whole spindle rots. In advanced stages of the disease, the spindle can be drawn out of the crown with a slight pull. Later, infection spreads to the outer whorl of leaves leading to their yellowing and dropping. The infected palm emits rotten disagreeable odour.

Early detection of the disease and prompt removal of the infected tissues will help in the recovery of the palm and also prevent the spread of the disease. Affected portion of the bud are to be scooped off by making a longitudinal side slit and the remaining healthy tissues treated with Bordeaux paste (100 gms copper sulphate—100 gms lime in 1 l of water). As a prophylactic measure the crown may be drenched with 1% Bordeaux mixture. Removal and destruction of dead palms, and bunches affected by *Koleroga* will minimise the disease incidence.

6·2·3. *Yellow leaf disease:* This disease is prevalent in southern Kerala, coastal Maharashtra, interior Karnataka and in some pockets of Tamil Nadu. Symptoms appear as yellowing of the leaves which appears on the leaf margins and progress inwards interspersed with green stripes. At later stages necrosis of lamina becomes more prominent. The Kernel of affected nuts are usually dark brown in colour and is unsuitable for chewing. Tips of feeder roots will become brittle and show different degrees of blackening. Electron microscopic examination of root tissue, rachillae and tender leaves from diseased palm showed the presence of mycoplasma like organisms (MLOs).

Since the disease is not amenable to control by conventional plant protection measures, other means of containing the disease have to be adopted. Yield of palms in the disease affected garden can be increased by adopting the following recommended management practices:

Regular fertilizer application at the rate of 100 g N, 160 g P_2O_5 and 140 g K_2O per palm per year.

Application of one kg lime per palm per year.

Manuring with green leaf at the rate of 12 kg and cattle manure @ 25 kg per palm per year.

Irrigation once in four days during summer months.

Placement of 2 g phorate granules (Thimet 10 G) in perforated polybags in the inner most leaf axil in April to control spindle bugs.

Protect the palms against other pests by adopting appropriate control measures.

Provide good drainage in the garden.

Grow cowpea or other cover crops in the interspace.

Removal of diseased palms to prevent further spread of disease.

6·2·4. *Anabe roga (Ganoderma lucidum):* Anabe roga or the foot rot of areca palm is a major problem in the *Malnad* and *Maidan* areas of Karnataka and also in parts of Tamil Nadu, Kerala and Assam. The disease is of wide occurrence in neglected gardens with poor drainage and high water table and spread through soil by root contact or through spores disseminated aerially through wind. Infected palms exhibit symptoms of severe draught with yellowing of outer whorl of leaves which at later stages droop and drop off. In advanced stages of infection small brown irregular patches appear on the stem and a brownish exudate oozes out from these patches. Roots of diseased palms show varying degrees of discolouration, rotting and become brittle. Internal tissues of the basal portions of the stem also exhibit similar discolouration. Later sporophores (bracket shaped fruiting bodies of the fungus commonly called *'Anabe'*) are produced at the base of the trunk.

Since it is difficult to identify the diseased palm in the early stages of infection, it is not possible to save the palm once it is affected or to eradicate the fungus. Proper management of the garden seems to be the only way to check the occurrence of disease. Better drainage and clean cultivation are important factors. Once a diseased palm is recognised it should be isolated by digging deep trenches all around, one metre away from the

base of the palm. The stumps of dead palms should be removed and destroyed by burning. Planting of trees like goldmohur *(Delonix regia)* and *Honge (Pongamia glabra)* in the vicinity of the garden should be discouraged as these trees act as collateral hosts of the fungus. These plants are also very susceptible to the pathogen. Digging trenches 60 cm deep and 30 cm wide around the 'Anabe' infested areca palms and drenching with 0·3% Captan at the rate of 3 g per litre of water prevent the spread of the disease. Phytosanitary measures like cutting and burning of the dead palm along with bole and roots should be followed strictly.

6·2·5. *Inflorescence die-back and button shedding:* It is a disease prevalent in Kerala and Karnataka especially during summer months from February to May. The symptoms are yellowing and drying of the rachis from tip towards the base followed by shedding of female flowers or the buttons. The disease may be due to several factors such as lack of pollination, insufficient nutrients, water and temperature stress or due to some other physiological factors. A pathogenic fungus *Colletotrichum gloeosporioides* is also associated with the die-back and shedding of buttons. The fungus enters the host tissue either through the scars of the shed male flowers or the sigmatic end along with the pollen grains.

Die-back and shedding of button due to the fungus can be controlled by two sprayings with Dithane Z–78 @ 4g per litre of water. The first spraying at the time of opening of female flowers and the second 20–24 days thereafter. Arueofungin sol mixed with copper sulphate both at 50 ppm (50 mg/litre) concentration is also effective in controlling the disease. Removal and burning of the affected inflorescence is very much essential in preventing the spread and severity of the disease.

6·2·6. *Nursery disease:* Collar rot of seedlings is an important disease occurring in nurseries. Water logging, poor drainage and accumulation of silt in the leaf axils are the predisposing factors for the disease. Collar region of the seedling is first affected by soft rot bacteria, which spread to stem portion and cause rotting of bud and spindle leaf. Soil fungi such as

Fusarium and *Rhizoctonia* accelerate the root decay and finally the plant succumbs to the disease.

Diseased seedlings are to be destroyed and pits drenched with 1% Bordeaux mixture. Incidence of disease can be reduced by providing good drainage and removal of silt deposite if present, following monsoon.

6·2·7. *Bacterial leaf stripe:* The disease is caused by a bacterial pathogen *Xanthomonas arecae*. This disease occurs in an endamic form in *Maidan* parts of Karnataka, especially around Tumkur. Symptoms appear as small water soaked spots, 0·5—1 cm wide on the leaf lamina. The lesions may develop at any point on the lamina but usually at the base or towards the tip of the leaflets. The reduction in yield up to 50% over a period of three years after the expression of symptoms has been observed. The margins are well defined, but becomes wavy due to lateral spread. The corresponding lower surface of the leaflets will be covered by the bacterial mass. This will be creamy white in the early stages but turns to grey or yellowish flakes or fine granules or irregular yellowish masses on drying. Infection leads to partial or complete blighting of leaf. Infection of young palms in the age group of 5–10 years may, in severe cases, lead to death of the palm.

The disease can be controlled by spraying streptocycline or tetracycline at the rate of 1 g per 2 litres of water. Spraying has to be done at fortnightly intervals starting from July till October.

6·2·8. *Band:* This disease is otherwise known as *Hidimundige* in Karnataka and is prevalent in Ratnagiri and Kolaba districts of Maharashtra and also seen in milder form in all the areca growing tracts. This disease is characterised by the production of small crinkled, dark green leaves, tapering of stem and reduction in internodal distance. In advanced stages the crown exhibits a rosette appearance. Inflorescence if at all produced will be small and malformed. A drastic reduction in yield is usually associated with the disease.

The occurrence of the disease can be reduced by providing good drainage and adequate aeration to the roots by removing hard soil strata. Further, application of a 1:1 mixture of copper sulphate and lime in the basin at the rate of 225 g per palm twice a year will improve condition of the diseased palm.

6·2·9. *Nut Splitting:* Nut splitting is considered to be a physiological disorder rather than a pathological problem. The disease is also known as *Anduadakke roga* in Karnataka and *Achikeeral* in certain parts of Malabar in Kerala. This abnormality is seen in patches in individual gardens and are common on young palms. The disease is characterised by the cracking of fruits, which may occur either near the perianth or the base or from both ends. Symptoms appear as yellowing of the nuts when they are half to three-fourth mature. Sometimes kernel also exhibits splitting. Improvement of drainage in areas of high water table is known to help in minimising the incidence. Spraying of Borax at the rate of 2 g per litre of water during the early stage of disease also reduces the splitting.

6·2·10. *Sun scorch and stem breaking:* Sun scorch is a condition which develops due to the adverse effect of solar radiation. Palms exposed directly to the south western sun are badly affected. Symptoms appear on the stem as golden yellow spots which later turn brown. In advanced stage fissures develop at these points. Further, saprophytic microorganisms and insects harbour in these portions and the stem ultimately breaks during heavy wind.

The palms can be protected from south western sun by tying areca sheath or leaves. Palms exhibiting fissures are to be reinforced by tying split areca stem. Planting of quick and tall growing shade trees on the south-western side of the garden and adoption of proper alignment while planting will greatly minimise the damage due to sun scorch.

7. Harvesting and Processing:

Harvesting of nuts at correct stages is very important for obtaining the produce of better quality. In *Chali* preparation

only ripe nuts are harvested. It should be ensured that only fully ripe nuts are harvested for preparation of *Chali*. The outturn of *Patora* and *koka* will be more if unripe or under-ripe nuts are harvested, which fetch low price in the market. After harvesting, the ripe nuts will have to be sun-dried for about 40–45 days. It is essential to spread the nuts uniformly in a single layer for drying. Proper drying of the nuts is important to prevent fungal infection of the nuts in the drying yard. Turning of nuts once a week may be attended to for uniform drying and better quality of produce. If the requirement for the market is tender processed nuts, then harvesting green fruits at an appropriate stage of about 6 months maturity is essential since produce prepared out of over-matured fruits fetches lower price in the market.

Dehusking of arecanut is traditionally done by skilled manual labour with the help of a tool which has a sickle shaped small pointed blade fixed on a plank. A simple device for dehusking arecanut developed by CPCRI can also be used. The main advantage of this device is that any unskilled person can operate it. The outturn is about 60 Kg husked nuts in case of dried nuts and 30 Kg in case of green nuts when one person operates the device for a day of 8 hours. The cost of the device is around Rs. 750/–.

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