PACKAGE OF PRACTICES

FOR

COCONUT

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PACKAGE OF PRACTICES FOR COCONUT

1. Selection of planting material

Selection of seednuts and seedlings is of utmost importance in coconut as the performance of the new progeny can be evaluated only several years after planting. Should the seednuts and seedlings happen to be of poor quality, the new plantation will prove to be uneconomic, causing considerable loss of time and money to the grower. The fact that the coconut is a cross-fertilised palm and that it does not breed true, makes the selection of seednuts and then of seedlings in the nursery all the more difficult and important. By means of a series of selections made at different stages, it is possible to eliminate poor quality seednuts and seedlings.

The selection procedure and nursery techniques are discussed in detail in CPCRI Extension Bulletin No. 2E, "Nursery Manual for Coconut", available from the Extension Agronomist, CPCRI.

2. Raising coconut gardens

2.1. **Selection of site:** Shallow soils with underlying hard rock, low lying areas subject to water stagnation and clayey soils are to be avoided as it will be

difficult to raise successful coconut plantations under such conditions. However, in lands reclaimed by heaping alternate layers of sand and clay, coconut thrives well. Proper supply of moisture either through well distributed rainfall, percolation of water or irrigation, and sufficient drainage are essential for coconut.

2.2. **Preparation of land and planting:** Preparation of land for planting coconut depends to a large extent on soil type and environmental factors. If the land is uneven and full of shrubs, the shrubs have to be cleared and land levelled before taking pits. The depth of pits will depend upon the type of soil. In laterite soil with rocky substratum, deeper and wider pits, 1.2 m × 1.2 m × 1.2 m, may be dug and filled up with loose soil upto a depth of 60 cm before planting. In loamy soils with low water table, planting in 1 m × 1 m × 1 m pits is generally recommended. However, when the water table is high, planting at the surface or even on mounds may be necessary.

2.3. **Spacing:** Spacing of palms requires careful consideration. A spacing of 7.5 to 9.0 m may be adopted depending on the crown size. This will accommodate 177 to 124 palms per ha under the square system of planting. If the triangular system is adopted an additional 20 to 25 palms can be planted. Also a hedge system can be adopted giving a spacing of 5.0 to 5.5 m along the rows and 9 to 10 m between the rows.

2.4. **Time of planting**: In well drained soils where water stagnation is not a problem, seedlings can

be transplanted with the beginning of south-west monsoon. If irrigation facilities are available, it is advisable to take up planting at least a month before the monsoon sets in so that the seedlings get well established before the onset of heavy rains. Planting can also be taken up before the north-east monsoon. In low lying areas subject to inundation during monsoon periods, seedlings are better transplanted after the cessation of the monsoon. In sandy soils burying of coconut husks in the pits before planting helps better establishment of the seedlings.

2.5. **Care of young palms**: Sufficient attention will have to be paid to the young palms in the early years of growth.

The transplanted seedlings should be shaded and irrigated properly during the summer months. Irrigation with 45 litres of water once in 4 days has been found to be satisfactory in sandy soils. Provision of proper drainage is also equally important in areas subject to waterlogging.

2.6. **Manuring**: An annual application of 500 g N, 320 g P_2O_5 and 1200 g K_2O per palm is generally recommended for adult plantations. Fertilisers like urea, ultraphos, rock phosphate, muriate of potash, suphala, Factamphos and commonly available fertiliser mixtures may be used to supply the required quantity of nutrients. Fertilisers may be applied in two split doses. After the receipt of summer showers one-third of the recommended dose of fertilizers may be spread around the palms within a radius of 1.8 m and forked in.

Circular basins of 1.8 m radius and 25 cm depth may be dug in July-August and green leaf or compost spread in the pits. The remaining fertilisers may be spread over the green leaf or compost in the first week of September and the basins covered.

Regular manuring from the first year of planting is essential to ensure good vegetative growth and early flowering and bearing, and high yields. The first application of fertilisers should be done three months after planting when the south-west monsoon ends on the West Coast if seedlings are planted before the rains in May-June (see Table). During the second year, one third of the dosages recommended for adult palms may be applied in two split doses in May and September-October. This dosage may be doubled during the third year. From the fourth year onwards fertilisers may be applied at the rates recommended for adult palms.

FERTILISER RECOMMENDATIONS FOR COCONUT (kg / tree)

	May-June			September-October		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
First year	Planting in May-June			50	40	135
Second year	50	40	135	110	80	270
Third year	110	80	270	220	160	540
Fourth year onwards	170	120	400	330	200	800

In addition, 1 kg of dolomite or 0.5 kg of magnesium sulphate per palm per year may be applied. 1 kg of lime per palm per year may be applied in acidic soils. Dolomite or lime may be broadcast in April-May in the

basins and incorporated into the soil by forking and should not be applied with other fertilisers. Magnesium sulphate can be applied along with other fertilisers in the basins in September.

It will be advantageous to supply large quantities of green leaf or compost where the soil is poor in organic matter content. The pits should be cleared of weeds periodically. Soil washed down by rains which may cover the collar of the seedlings should also be removed. The pit should be widened every year before the application of manure. The pits should be gradually filled up as the seedling grows. The palms should be frequently examined for any insect attack or fungus disease and necessary remedial measures should be taken promptly.

2.7. **Intercultivation**: Regular intercultivation and adequate manuring are very essential to step up and maintain the production at a high level. Tillage operations like digging the garden with mammotty, ploughing, forming small mounds in August-September and spreading them in December-January and making shallow basins with a radius of about 2 m at the beginning of monsoon and filling up at the close of monsoon are beneficial to the trees. In sandy soils, which are generally of low fertility and do not have a luxuriant growth of weeds, regular inter-cultivation may not be necessary, but in other soils which permit rank growth of weeds, intercultivation will be necessary to keep weeds under control. Method of intercultivation will depend upon local conditions, availa-

bility of labour, size of holdings, soil type, topography and distribution of rainfall.

2.8. **Irrigation**: The coconut palm responds to summer irrigation. Under West Coast conditions, 6 cm irrigation once in two weeks during summer months has been found to be beneficial in sandy loam soils in increasing yields. Where basin irrigation is practised, 200 litres per palm once in four days may be given.

2.9. **Cover cropping**: Cover cropping is recommended to prevent soil erosion in coconut gardens. This will also add organic matter to the soil. Leguminous crops such as *Mimosa invisa*, *Stylosanthes gracilis*, and *Calopogonium mucunoides* are generally recommended. Green manure crops like sunhemps and kolinji can also be raised and ploughed in during August-September. These crops can be sown in April-May when premonsoon showers are received.

2.10. **Inter and mixed cropping**: A variety of intercrops like pineapple, banana, elephant foot yam, groundnut, chillies, sweet potato and tapioca can be raised in coconut gardens after the palms attain a height of 5 to 6 meters. In older plantations, cacao, pepper, cinnamon, clove and nutmeg can be grown as mixed crops. In places where rainfall is not well-distributed, irrigation may be necessary during summer months. However, these crops are to be adequately and separately manured in addition to the manures applied to the coconut palm.

2.11. **Mixed farming**: Milk is scarce in areas where coconut is extensively grown mainly because of

nonavailability of fodder. Mixed farming by raising fodder grasses such as hybrid napier or guinea grass along with leguminous fodder crops such as *Stylosanthes gracilis* has been found to be profitable. Raising the above crops in one ha of coconut garden can support four dairy animals. The animals also supply large quantities of cattle manure which, when applied to the area, improves the soil fertility considerably. Trials conducted at Kayangulam have shown that by maintaining 5 milch cows in an area of 1.3 ha of coconut garden an additional net income of Rs. 2,850 per year could be obtained. In addition, the yield of the palms improved markedly.

3. Diseases

The coconut palm is affected by a number of diseases, some of which are fatal while others gradually reduce the vigour of the palm causing severe losses in yield. Some of these diseases such as bud rot, leaf rot and stem bleeding are localised on specific parts of the palm and others like the root (wilt) disease are systemic affecting the whole plant. The following is a brief account of the important diseases of coconut in our country.

3.1. **Bud rot**: This disease caused by a parasitic fungus, *Phytophthora palmivora* has been reported from all coconut growing states. The first symptom of the disease is the yellowing of one or two young leaves surrounding the spindle. The spindle withers and drops down. The tender leaf bases and the soft tissues of the crown rot into a slimy mass of decayed material, emitting

a foul odour. The disease proves fatal if it is not checked in the early stage. Even after the death of the central bud the outer leaves and bunches may continue to remain intact for many months. Palms of all ages are susceptible to the disease, but it is more frequent in young palms. The disease is rampant during the monsoons when the atmospheric temperature is low and the humidity is high.

If the disease is detected in the early stage when the spindle is just withering, Bordeaux paste (100 g of copper sulphate and 100 g quick lime each dissolved in 500 ml of water separately and mixed together to make 1 litre) could be applied on the crown after removing the infected tissue and a thorough cleaning. The treated wound should be given a protective covering till the next normal shoot emerges. Badly affected trees which are beyond recovery should be cut and burnt. As a prophylactic measure, all the healthy palms in the vicinity of the diseased one should be sprayed with 1% Bordeaux mixture.

Preparation of Bordeaux mixture: Dissolve 1 kg of copper sulphate crystals in 50 litres of water. In another 50 litres of water prepare milk of lime with 1 kg of quick lime. Pour the copper sulphate solution into the milk of lime slowly, stirring the mixture all the while. Test the mixture before use for the presence of free copper (which is harmful to the palm) by dipping a polished knife in it. If the blade shows a reddish colour add more lime till the blade is not stained when dipped afresh in the mixture. Always use wooden, earthen or copper vessels for the preparation of Bordeaux mixture.

3.2 **Leaf rot:** This disease caused by a fungus, ***Bipolaris halodes*** is mostly prevalent in the southern districts of Kerala and generally occurs on palms already affected by root (wilt) disease. The first symptom of the disease is a blackening and shrivelling up of the distal ends of the leaflets in the central spindle and in some of the younger leaves. Later, the affected portion breaks off in bits giving the infected leaves a fan-like appearance. If no protective measures are taken, each new leaf of the diseased tree gets infected with the result that a stage is soon reached when all the leaves of the tree show disease symptoms. The reduction in leaf surface adversely affects the yield.

Spraying the leaves with 1% Bordeaux mixture or any other proprietory copper fungicide such as 0.5% Fytolan after removing all affected material once in January, April–May and September controls the disease.

3.3. **Leaf blight or grey leaf spot:** This fungal disease caused by ***Pestalotia palmarum*** is common in most of the coconut growing states. The disease symptoms develop in the mature leaves of the outer whorl. Minute yellow spots encircled by greyish bands appear on the leaf surface which later become greyish white. These spots coalesce into irregular necrotic patches. Complete drying and shrivelling of the leaf blade are common when the infection is severe.

Removal of the older affected leaves and spraying the foliage with 1% Bordeaux mixture will check the spread of the disease.

3.4. **Mahali or fruit rot and nutfall**: Shedding of female flowers (buttons) and immature nuts are the symptoms of the disease. Lesions appear on the young fruit or buttons near the stalk which later develop into a decay of the underlying tissues.

This disease is caused by a fungus *Phytophthora* sp. which appears as whitish webby growth on the surface of the affected part. The pathogen is more active during the rainy season when the atmospheric conditions are favourable for its growth.

A premonsoon spraying followed by one or two sprayings at intervals of 40 days is generally advisable. Spraying the leaves with 1% Bordeaux mixture or any other effective copper fungicide such as Fytolan (0 5%) will control the disease. The shed nuts should be collected and burnt.

3.5. **Stem bleeding**: A typical symptom of the disease is the exudation of a reddish brown liquid through cracks developing on the trunk. The first cracks are generally noticed in the lower portion of the stem but they spread throughout as the disease advances. On drying, the liquid turns black. The tissues around the bleeding points start decaying first which later develops into a general decay of the tissues underneath the bark. Fatal instances of stem bleeding are not uncommon.

The cause of the disease is unknown The fungus *Ceratostomella paradoxa* has been found to be associated with the disease. It is believed that physiological

disorders may have a role in the occurrence of the disease.

The damage to stems can be checked to a certain extent by completely removing the affected tissues by means of a chisel and dressing the wound with hot coal tar or Bordeaux paste.

3-6. **Anabe roga**: This disease is caused by the fungus *Ganoderma lucidum.*

The older leaves which start drooping and withering remain suspended around the trunk for several months before they are shed. Younger leaves remain green for some time. The trees become barren due to the suppression of the infloresence. The crown is reduced in size and the new leaves become smaller and yellowish in colour which finally wither as the bud decays.

The palms in certain areas of Karnataka, in addition to these symptoms, show bleeding patches around the base of the trunk. A brownish gummy juice exudes from these patches which slowly results in the death of the outer tissues of the trunk. As the infection advances higher up the trunk, fresh bleeding patches develop above the older ones. The tree succumbs to the disease in about two years. The sporophores (fruiting body) of the fungus are not commonly met with, but may sometimes be seen under the scaling bark close to the ground on diseased palms.

The disease can be kept under control by destroying the infected palms and preventing the spread of the fungus by digging insolation trenches about 50 cm wide

and one metre deep, two metres away from the diseased palms.

3.7. **Root (wilt) disease**: This is the most serious disease of coconut in the central and southern districts of Kerala. The disease has been prevalent in the state for nearly 100 years and is believed to have made its appearance after the great floods of 1882.

The important diagnostic symptoms of the disease are an abnormal bending or ribbing of the leaflets, termed "flaccidity", a general yellowing and marginal necrosis of the leaves and deterioration and decay of the root system. The yield of affected palms will be considerably reduced. The nuts of affected trees are generally smaller and the kernels are thin. The oil content of copra is also reduced.

The reduce losses due to the disease in affected gardens the following measures are suggested:

1. Remove severely diseased trees with poor yield (less than 10 nuts) and all diseased seedlings after spraying with 0.1% carbaryl or dichlorvos to annihilate any insect vectors present. The stumps may also be removed.
2. Plant only seedlings received from nurseries in healthy area.

4. Pests

The most serious pests of coconut are the rhinoceros beetle, *Oryctes rhinoceros*, the leaf eating caterpillar, *Nephantis serinopa*, the red palm weevil, *Rhynchophorus*

ferrugineus, and the root-eating cockchafer, *Leucopholis coneophora*.

4.1. **Rhinoceros beetle**: This is the most serious pest which has an ubiquitous distribution. The adult beetle bores through into unopen fronds and spathes. The attacked frond when fully open shows characteristic geometric cuts. Attack on spathes often destroys the inflorescence and thus prevents production of nuts. The beetle breeds in a variety of materials such as decaying organic debris, farm yard manure, dead coconut stumps, and compost. The total duration of the life cycle of this pest is about six months.

Rhinoceros beetle is a prolific breeder. A mechanical method of control is hooking out the beetle by beetlehooks without causing injury to the growing point of the palm. Filling the innermost three or four leaf axils of palms with a mixture of 5% BHC dust and sand in equal proportions is an effective prophylactic measure. Three applications in April, September and December are necessary to give sufficient protection to palms in heavily infested areas. Treatment of all the possible breeding sites of the beetle with 0.01% BHC or carbaryl is an effective method of controlling the grub of this pest. For 3 cu. m of breeding material, 350 g 50% BHC / carbaryl will have to be used. Field trials using 0.01% BHC conducted in cultivators' fields have shown remarkable reduction in pest attack. The resultant increase in yield obtained due to this pest control operation was of the order of 5 to 8 nuts per tree per year.

4.2. **Leaf-eating caterpillar**: Leaf-eating caterpillar is another serious pest of coconut in the coastal

and backwater tracts. The caterpillar of the pest lives on the undersurface of leaflets inside galleries and feed voraciously on the functional tissues. This affects the health of the palm adversely and results in reduction of yield. The severity of attack by this pest will be marked during the summer months from January to May. With the onset of south-west monsoon the pest population begins to decline.

Spraying of infested palms with 0 2% BHC or 0.05% Malathion on the under surface of leaves (1 kg of 50 per cent BHC W.P. or 500 g of 25 per cent Malathion in 250 *l* of water) so as to give a thorough drenching to the larval galleries would give satisfactory control of the pest. Treatment may be done at quarterly intervals in March, June, September and December depending on the abundance of the pest in the field. Since this pest is subject to the attack of a number of indigenous parasites biological control is also possible. Mass multiplication, liberation, and colonisation of parasites in infested fields control the pest population.

4.3. **Red palm weevil**: Red palm weevil is the most dreaded enemy of young palms. Since this pest is a tissue borer its detection in early stages of infestation is rather difficult. The diagnostic symptoms are the presence of holes, oozing out of a viscous brown fluid and extrusion of chewed up fibres through holes, longitudinal splitting of leaf bases and wilting of central shoot. Sometimes the gnawing sound produced by the grubs feeding inside will also be audible. Quite often, the infestation would become evident only when the

growing point of the palm is damaged and the crown has toppled.

Attacked palms can be saved by injection of Pyrocon–E or carbaryl at 1% concentration. Ten ml Pyrocon –E or 20 g of 50% carbaryl (Sevin) in 1 litre of water per palm should be introduced into the trunk through a hole above the pest infested portion, using an auger and a funnel. All the holes on the stem should be plugged before injecting the palm. If the pest infestation is through the crown, the insecticide suspension should be slowly poured in after cleaning the crown of all affected materials. Trichlorphon, 0.2% is also found to be effective in controlling this pest. A prophylactic treatment of filling of leaf axil with BHC or chlordane 5% dust and sand mixture in April, September and December reduces the weevil attack.

Entry of this pest through the cut ends of the leaf base can be prevented by leaving a length of 120 cm of the leaf base while cutting leaves. Cutting steps on the stem for climbing also has to be avoided for checking the entry of this pest.

4.4. **Root-eating cockchafer**: The soil-inhabiting "white grubs" cause damage to the roots of coconut. Besides coconut, it attacks crops like tapioca, colocasia and sweet potato in coconut gardens. The leaves of attacked palms turn pale yellow. In cases of heavy infestation immature nuts are shed.

Tilling or deep ploughing of infested soil will reduce the pest population. Soil application of 5% Aldrin,

BHC or chlordane at the rate of 120 kg/ha twice a year in April-May and August will control the pest. The insecticide is to be broadcast and incorporated into the soil by tilling and ploughing.

4.5. **Rats**: Rats damage tender nuts and cause severe loss in many places. Shed tender nuts with holes can be located at the base of the affected trees.

Rats are controlled by providing mechanical barriers (bands), poison baits and traps. 40 cm wide G. I. sheet bands around the trunk at a height of 2 m from the ground will serve as mechanical barriers. The rats may be baited using poisons such as zinc phosphide or Rodafarin. Rat burrows in the field may be fumigated with cyanogen gas.

4.6. **Minor pests**: Among the minor pests, the slug caterpillars like *Contheyla rotunda* and *Parasa lepida* at times appear in sporadic proportions and become serious pests. Spraying the palms with 0.1% BHC or carbaryl would effect satisfactory control of these pests.

Coconut bunches can be protected against bats (*Pteropus edwardsii*) by covering them with thorny branches of wild plant *Zizyphus* around them.

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