Guidelines for Establishing Coconut Seed Garden and Raising Coconut Seedlings

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Introduction

In coconut, seedlings vigour is highly correlated with adult palm characters such as early flowering, nut yield and copra production (Liyanage and Abeywardena, 1957). If the seed nuts happen to be of poor quality, the new plantation will prove to be uneconomic, causing considerable loss of time and money to the grower. Coconut being a perennial plant, the performance of the new progeny can be judged only several years after planting. Further, being cross-fertilized, it does not breed true and makes the selection of seed nuts and seedlings more difficult. One of the essential factors responsible for increasing the productivity and production is the availability of quality planting materials from selected varieties and hybrids.

The existing facilities for the production of quality planting materials are meager in coconut, which has adversely affected the development programmes of this crop. The major coconut producing states in India are Kerala, Tamil Nadu, Andhra Pradesh and Karnataka which together accounts for more than 80 per cent of area and production in the country. The crop is also grown in Orissa, Maharashtra, Gujarat, Andaman and Nicobar Islands, Lakshadweep Islands, Goa, Daman and Diu and also in limited extent in Assam, Tripura, Madhya Pradesh, Bihar and Manipur. The most popular and common cultivar available is the local tall of the respective states. A few dwarf types are also seen mainly in homesteads, grown for tender nuts and ornamental purposes. Though the number of coconut seedlings required annually for fresh planting, replanting and under planting in the diseased areas runs to several millions, until now no systematic planning to produce them out of superior materials has been made. Only this year Coconut Development Board has launched a scheme "Aid to private nurseries and seed gardens" in the coconut growing states like Kerala, Tamil Nadu and Karnataka. This will go a long way in augmenting the requirement of quality seedlings in coconut. This paper

Table 1. Performance of released coconut varieties and hybrids

Varieties/hybrids	No of nuts/ palm/year	Copra yield		Oil content (%)	States for which recommended	Institution responsible for release
		Mean/nut (g)	Mean/ palm (kg)			
Lakshadweep Ordinary	97	195	18.9	72	Kerala, Karnataka	CPCRI
Benawali Green Round	151	152	22.7	65	Goa	CPCRI
Philippines Ordinary	110	198	21.8	65	Kerala	CPCRI
Chandrasankara (COD x WCT)	116	215	24.9	68	Kerala	CPCRI
Kerasankara (WCT x COD)	108	187	20.2	68	Kerala, Maharashtra, Andra Pradesh	CPCRI
Chandralaksha (LCOT x COD)	109	195	21.2	69	Kerala	CPCRI
Lakshaganga (LCOT x GBGD)	108	195	21.1	70	Kerala	KAU
Anandaganga (ADOT x GBGD)	95	216	21.1	68	Kerala	KAU
Keraganga (WCT x GBGD)	100	201	20.1	69	Kerala	KAU
Kerasree (WCT x MYD)	130	216	28	66	Kerala	KAU
Kerasoubhaghya (WCT x SSA)	130	195	25	65	Kerala	KAU
VHC-1 (ECT x CGD)	98	135	13.2	70	Tamil Nadu	TNAU
VHC-2 (ECT x MYD)	107	152	16.3	69	Tamil Nadu	TNAU
Godhavariganga (ECT x GBGD)	140	150	21.0	68	Andra	APAU
WCT (Check variety)	80	176	14.1	68		

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describes the methodology for establishing seed gardens and raising quality seedlings of coconut.

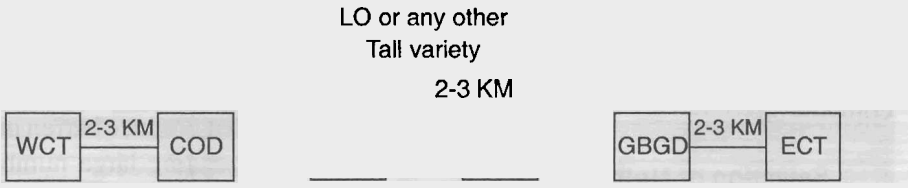
Performance of varieties and hybrids

Systematic evaluation of varieties over the past several years resulted in the selection of three high yielding varieties, namely Lakshadweep Ordinary (Chandrakalpa), Benawali Green Round (Pratap) and Philippines Ordinary (Kerachandra) for coconut growing tracts of India (Nair *et al.*, 1995). The nut yields in these varieties were >97 nuts/ palm/year as compared to local tall WCT (80 nuts/palm/year). Nearly 80 hybrid combinations have been evaluated over the years in India and so far eleven hybrids were released for establishing seed gardens and commercial cultivation (*Table 1*). The nut yields of hybrids were much higher (>100 nuts/palm/year) compared to around 80 nuts produced by tall (WCT) cultivar under rainfed conditions (Nair and Nampoothiri, 1993; Iyer and Damodaran, 1994).

Method of Establishing Seed Garden

The earlier method adopted for establishing seed gardens for hybrid seed production was to plant talls and dwarfs in alternate rows by simple emasculation of the female parent. Both D x T and T x T hybrids could be produced either through natural crossing if pollinating agents are available or through assisted pollination. However, in view of the easiness of operation, the present approach is to plant dwarfs and talls in separate compact blocks. A simplified crossing technique developed by the Central Plantation Crops Research Institute for the production of hybrid coconut seeds is now being used in various seed gardens in the country. Since the availability of pollen garden in the vicinity is always preferred, it is suggested to plant the tall pollen parent in compact areas, two to three km away from the dwarf seed garden. This will help in avoiding the storage and long distance transport of pollen. The layout of seed garden blocks as given in *Fig 1*, would help in the production of D x T, T x D and T x T combinations depending upon the requirements and operational easiness. Periodic inspection of the tall and dwarf varieties planted in seed blocks should be undertaken and the off types and low yielder removed to ensure varietal purity and better progeny performance. If the tall pollen parent is established in a larger block, the same will meet the needs of both pollen as well as that of the seed nuts of the tall. The availability of planting materials especially that of dwarfs is very much limited in the country. Hence, every effort has to be made to conserve and channelise them to these seed gardens in order to achieve the estimated targets for the establishment of seed

Fig. 1. Layout of seed garden blocks



(All round the blocks it is required to put a border row of same variety for maintaining the purity of parents)

Table 2. Parental source available in the country

State and Farm	Name of cultivars available
Kerala	
CSF, Aralam	COD, MYD, MOD, MGD, LO, WCT
SGC, Nilambur	COD, LO, MYD, WCT
CPCRI, Kasaragod	COD, MYD, MOD, MGD, CGD, LO, WCT
Chowghat area (culitvators garden)	COD
Karnataka	
Dharmaveera Hort. Farm, Bellara	COD, WCT
Kannamangala Farm	WCT, COD, CGD, GBGD, LO
NRCC, Shantigodu	COD, CGD, AO
Tamil Nadu	
Navolk, Ranipet	COD, ECT
Balaji Garden	COD
Ettankulam	COD
Tirunelveli	MYD, MOD
Neyveli	ECT
Orissa	
Bishwanahakani	COD, MYD, MGD, WCT
Konark	COD
Andra Pradesh	
East Godavari	GBGD
Tadepalligundam	GBGD, ECT

MYD - Malayan Yellow Dwarf; MOD- Malayan Orange Dwarf; MGD- Malayan Green Dwarf
COD -Chowghat Orange Dwarf; AO - Andaman Ordinary; LO - Lakshadweep Ordinary; ECT - East Coast Tall
WCT - West Coast Tall; GBGD - Ganga Bondam Green Dwarf

gardens in different states. The sources of availability of planting materials in coconut are given in *Table 2.*

Coconut palm is prone to infestation by a large number of pathogens, insects and non-insect pests. These pests and diseases cause damage to various parts of the crop causing considerable crop loss. The seed garden should be free from the incidence of diseases and not prone to severe attacks of pests. Phytosanitation besides, timely prophylactic and curative measures can prevent the crop losses and thereby increase the production and productivity. Also avoid planting seed garden in very fertile soils and near cattle sheds and compost pits.

Selection of Mother Palms

i) Palms should be regular bearers with annual yield of greater than 80 nuts and copra content not less than 150g/nut under rainfed condition (irrigation-120 nuts/ year).

ii) Palms should have reached full bearing stage and have been giving consistently high yield for at least four years.

iii) Avoid very old palms of above 60 years age.

iv) Seed nuts can be collected from the newly established seed gardens irrespective of the age of the palms as the performance of its parents is known and only high yielders are maintained.

v) Palms should have atleast 30 fully opened leaves having leaf orientation to all directions i.e. umbrella shape crown are ideal.

vi) The leaves should have short strong petioles with wide leaf base firmly attached to the stem.

vii) Their arrangement should provide support to the bunches.

viii) Each leaf axil should have one inflorescence with large number of spikes and one or two female flowers per spike.

ix) Bunch stalk should be short, stout and strong and should not show any tendency to droop down or buckle.

x) Palms having medium sized nuts (about 1200 g when the husk is fully dried) with round and oblong shape. Husked nuts should be large (about 570 g) with thick kernel.

xi) Palms that produce barren nuts or those shedding large number of immature nuts should be discarded.

Collection of Seed Nuts

i) The season of seed nut collection may vary from region to region. Always it is better to collect nuts that had undergone development during rainy season for seed nut purpose. Collect seed nuts from January to April on the West Coast region.

ii) Only fully matured nuts. i.e. about 12 months old should be harvested.

iii) Nuts should not be damaged while harvesting.

iv) Discard nuts having irregular shape and size and improper development.

Raising Nursery

i) Select well-drained, coarse-textured soil near dependable water source for irrigation. The selected site for a coconut nursery should be located in a place free from diseases of the coconut tree.

ii) Prepare raised beds if water stagnation is a problem during rainy season.

iii) Soil may be treated with HCH 10% @ 60kg/ha or chlordane 5% dust @ 120 kg/ha in place where nursery is taking for the first time as a precaution against white grubs and termites.

iv) Nursery can be raised either in the open with artificial shade or in gardens where the palms are tall and the ground is not completely shaded.

v) The seednuts should be planted in long and narrow beds at a spacing of 40 x 30 cm during May-June, either vertically or horizontally in 20-25 cm deep trenches.

vi) The nuts are placed in the seed bed in a horizontal or vertical position with stalk end up and in such a manner that the husk appears just above the surface of the soil.

vii) The seed nuts collected from particular area must be sown separately in blocks along with the sign boards put up indicating the variety and place of collection of such nuts.

Care and Management of Nursery

i) Light and frequent watering to be done during dry season.

ii) Mulching and shading should be done immediately after the monsoon ends, when the nursery is raised in the open space.

iii) Keep the nursery free of weeds.

iv) Regular surveillance for any incidence of pests and diseases.

(Contd on page 21)

(Contd from page 12)

v) Remove those nuts that have not sprouted even after five months of sowing.

Technique of Raising Polybag Nursery

Raising of coconut seedlings in polybgas was introduced in 1969 in the Ivory Coast (Wuidart, 1981), superseding the technique of conventional field nursery for production of vigorous seedlings. Their advantages and disadvantages in planting programmes have been well documented (Harries, 1983; Reddy *et al.*, 1996). This technique has certain drawbacks, unless seedlings are raised in close proximity to the planting site the cost of transportation would be more. Besides, the extra labour for filling bags and materials costs are the major constraints in the polybag nursery system.

Selection of Site

The nursery must be located near a dependable water source to facilitate satisfactory irrigation throughout the year. Moreover, to reduce the transportation cost, it should be near the site of field planting. The land should be generally flat. It is to be weeded, levelled and topsoil compacted. About 25,000 seedlings can be accommodated in one-hectare nursery area at a spacing of 60 x 60 cm.

Filling the bags and sowing

The bags are made of black polyethylene of 500 gauge thickness and 60 x 40 cm size for bigger nuts and 40 x 40 cm for smaller nuts. The bottom portion of bag should be provided with 8 to 10 holes for draining excess water.

Polybags of the above sizes usually take in about 13-16 kg top soil for filling two-third portion of the bag. The commonly recommended media are top soil mixed with sand in the ratio of 3:1, loose friable soil, river sand in combination with with the cattle manure and coir dust and soil and compost mixture in 1:1 ratio. Decomposed saw dust, corn cobs, rice hull or similar organic materials can also be used. The study at CPCRI, Kasaragod has shown that sowing in potting mixture medium, 1:1:1 mixture of red earth, cow dung and sand either in polybag or cement tank was beneficial in producing vigorous seedlings (Reddy, 1998). Sowing in potting mixture not only holds more moisture but also provides better nutrition to growing seedlings and helps to get higher recovery. In Sri Lanka, it was reported that river sand could be a successful alternative to the more expensive potting media currently used in polybags (Peries and Everard, 1991). However, further study indicated that a mixture containing 3 parts of river sand, 2 parts of cow dung and 1 part of coir dust was shown to be the best (Perera *et al.*, 1996). Since, the potting mixture is not only costly but, now-a-days the availability is also very much limited, the study on alternative media indicated that sand + vermicompost mixture in 1:1 proportion, sand + P & K fertilizers +Biofertilizer treatments were similar in response to potting mixture media in terms of seedling growth, physiological parameters and the final seedling vigor (Reddy *et al.* 2001). Therefore, sand + Vermicompost mixture or sand + P & K fertilizers + Biofertilzer treatments could be considered to replace potting mixture in raising polybagged coconut seedlings. The effect of biofertilizer treatments not only helps seedling growth in polybag, possibly it may also result in better establishment of microbial population in the main field when field planted with these polybag seedlings and helps in better growth and development and establishment of seedlings.

In the conventional nursery system there should be more than 80 per cent germination in 20 weeks with optimum management and seed nuts that do not germinate by then are discarded as failures (Harries, 1983).

In polybag system, seed nuts are allowed to germinate in a pre-nursery bed, sown very closely and transplanted in polybags when the sprouts are 8-10 cm long. The germinated nuts are picked out from the nursery once a week until 80 per cent of nuts are germinated or upto 5 months from sowing whichever is earlier, for transplanting. The germinated nut is placed in the half-filled bags with the sprout planted vertically in the centre of the bag and enough potting mixture is added to fill the bag upto two-third portion and the sides slightly pressed to keep the nut firm so that is not bared during watering. Care must be taken not to cover the collar of the young seedling. The seednuts may be dipped in carbaryl 0.2% solution prior to planting as precaution against termite attack.

Laying out of Polybag Nursery

The size and layout on land depends the irrigation system adopted and spacing of bags. Spacing of the bags, mainly depends on the time the seedlings are to remain in the nursery. The size of the polybag nursery bed can be 3 x 6 m with about 1.5 m spacing between beds. Each bed can accommodate 115 seedlings and these bags are arranged in a triangular manner with 60 cm space between bags.

Maintenance

Irrigation : Regular watering of the polybag nursery is very important to ensure proper growth of seedlings. The frequency of watering should be adjusted depending upon rainfall and other weather conditions, age of the

seedlings and type of potting mixture used. Irrigation may be required every alternate day during the summer months on the west coast. Several irrigation systems are available, and the choice must take various factors like ease of use, size of nursery, movement between the seedlings and capital investment into consideration. Sprinkler irrigation is preferable for larger nurseries. In small nurseries, hose irrigation is commonly practiced. However, care must be taken not to wash the medium out of the bag.

Weeding : Weeds adversely affect the growth of seedlings and therefore, it is essential to have weed-free nursery and also keep the surroundings clean by controlling the weeds as and when required.

Fertilization : The coconut has considerable reserves of essential plant nutrients in its nut. However, the roots are capable of absorbing the nutrients one month after their initiation and therefore benefit from fertilizer application. Thus, an optimum fertilizer schedule to derive the best benefit from substrata in polybags is worthy of further investigation. At the moment, application of 20 g ammonium sulphate and 25 g potassium chloride after 2 months of germination and 45 g ammonium sulphate and 45 g potassium chloride after 4 months of germination per bag as recommended in Indonesia may be adopted (Ratnambal, 1995). The fertilizer is spread around the seedlings and forked into the medium. The polybag must be watered on the same day.

Plant protection : Careful inspection is a must in both polybag and field nurseries for detecting the incidence of pests and diseases and suitable plant protection measures are to be taken up as soon as insect/disease symptoms are noticed.

Ants and termites : The medium around the nut is to be treated with chlordane 5% dust in the bags.

Scales and mealy bugs : Spray dimethoate 0.05% on the under surface of the leaves.

Mites : Spray dicofol or dimethoate 0.05% on the under surface of the leaves.

Leaf-defoliators : The whole foliage is to be sprayed with carbaryl @ 20 g in 15 litres of water.

Fungal diseases : The most widespread fungal diseases are leaf spots caused by *Helminthosporium, Pestalotia* and *Colletotrichum* and bud-rot caused by *Phytopthera.* In areas where there is a risk of attack, preventive treatments should be given twice a month, spraying both sides of the leaves with a solution of Bordaux mixture (1%) or Indofil-M45 (0.3%). To back up the treatment, severely infected leaves can be removed and burnt to avoid dissemination of sproes.

Preparation of Plants for Field Planting

The selected seedlings (10-12 months old) should be prepared on the eve of their transport to the field for planting. They are abundantly watered to ensure a moisture reserve, handled with care to avoid baring them or tearing the bag. If the roots have grown through the bag, they must be cut before being moved from the nursery. The plant should not be held at the collar, which will unearth it. There is also a scope for introduction of bio-fertilizers like VAM (vesicular arbuscular mycorrhizae) and phosphate solubilizers in the polybag before field planting for better establishment of organisms. In the case of field nursery, seedlings should not be pulled out of the seed bed by force, but the seedling with the nut gently removed by holding the nut.

Seedlings Selection in the Nursery

i) Seedlings should be healthy and vigorous with large number of leaves. Good girth at the base, short, thick leaf stalks and large number of roots.

ii) Every coconut nursery contains some plants which are deformed or whose development is stunted and those that are thin and lanky should be rejected.

iii) Select seedlings that have germinated early.

iv) From the one-year-old nursery, select vigorous seedlings having minimum of six leaves and girth of 10 cm at the collar.

v) Early splitting of leaves is a good indicator of the rapid developers and early bearing.

vi) The recovery of good seedlings will be 60 to 65% of total seednuts sown.

Maintenance of Nursery Registers

The particulars of parent trees, seed nuts collected, nuts sown and nuts germinated should be recorded in a register in every nursery. There should be also a record kept for observations made in the nursery.

Summary

Since the performance of a coconut plantation depends very much on the quality of planting material, establishment of systematic seed gardens, collection of best quality seed nuts and proper method of raising seedlings under careful maintenance is indispensable for the production of vigorous seedlings in the released coconut varieties and hybrids. The polybag nursery in coconut is agronomically a step forward, providing well-developed and vigorous seedlings

with excellent rooting. The seedlings may be costlier than the seedlings from the field nurseries, but this is amply compensated by the vigorous seedlings with reduced root damage and absence of transplanting shock, resulting in quicker establishment and early flowering.

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