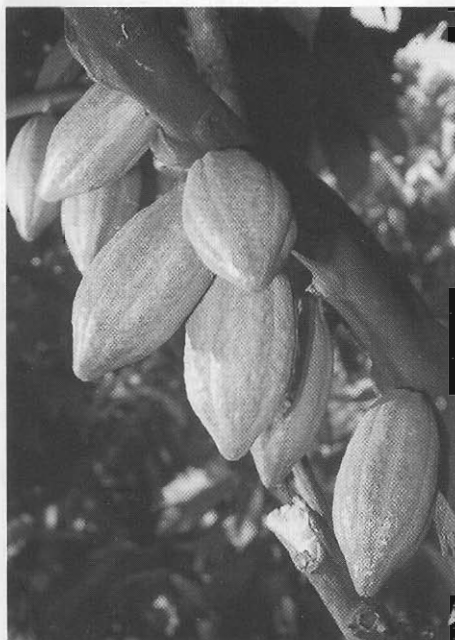


Producing quality planting material of cocoa



The cocoa fruit



Polybag nursery of cocoa

COCOA, an important plantation crop, is grown as a mixed crop in coconut and arecanut gardens. To encourage this internationally acclaimed crop in India, intensive area expansion programmes are being taken up by developmental agencies. The foremost necessity to get its sustainable yield is the supply of quality planting material. Cocoa is multiplied both by seeds and vegetative means. Production and management of planting material in nursery decides the performance of cocoa in the field and ultimately the quality of its value-added products.

SELECTION OF MATERIAL

Selection of Mother Trees and Pods

Trees bearing a lot of fruits with biggest pods can be selected. Trees of Forastero type (green-immature, yellow-ripe) having medium to large pods of not less than 350 g weight, smooth or shallow furrows on surface without prominent constriction at the neck can be selected. Husk thickness of pods should be more than 1 cm. Number of

pods required to produce 1 kg wet beans should be not more than 12, while number of beans/pod more than 35.

Raised Bed Nursery

Small, plain and flat plot with adequate sunlight (25–50%), rich soil and a water source should be selected. Soil should be tilled deeply and lumps of earth should be broken up to get a fine tilth. Beds of 90–120 cm width and of convenient length are preferred. A path of 60 cm as walking space between one bed and the next to monitor the nursery is needed. While sowing enough space between furrows and seeds should be given which enhances better growth before transplanting to main field (up to 4–6 months it should be in nursery-bed). Young cocoa seedlings are very delicate and should be protected from sunlight by putting them under shade net at 180 cm high above each bed or by covering with palm fronds. Sorting of healthy seedlings is possible in nursery-bed. Too young seedlings do not grow well or die and they can be sorted out.

Polybag Nursery

To get better root and shoot growth, and to make the planting easy sowing seeds in polythene bags or small baskets is being followed. Polybags of 6" x 9" size and 250 gauge filled with a rooting mixture of 2:1:1 soil: sand: FYM and baskets or bags 30 cm high and 20 cm wide can also be used. Bags or baskets should be arranged in rows leaving a little path between rows for monitoring. Shade nets or covering by thatches is needed. Young seedlings needs a lot of water and should be irrigated gently everyday in summer and once in alternate days in other seasons.

Sowing

Extract bold, larger beans from well-matured, big seed pods of ideal plants. Sow them immediately. Seeds should be kept horizontally or vertically with hilum end down and just cover with sand. Pushing of seeds deeply into bed or polybag should be avoided because lack of air may affect seed germination. Though its seeds germinate at any time of the year, they may preferably be sown by December–January so that 4–6 months old seedlings become available for planting by May–June.

Management

Mechanical killing of insects and burning of diseased plants is advisable. Intermittent removal of weeds is necessary otherwise all nourishment is taken away. Provid sufficient shade during summer season, remove shade nets during rainy and winter seasons.

Transplanting

Only vigorously growing seedlings should be transplanted. If seedlings are grown under heavy shade, hardening for 10 days by exposing them to sunlight is necessary before transplanting. Watering of beds should be done before lifting seedlings for transplanting to avoid breakage of roots. Polythene bags should be removed and seedlings are planted with ball of earth in pits.

Directly we can place the wire baskets in pits dug in the plantation. It rot in the earth in due course. While planting grafts polythene strip tied over graft joint should be removed and it should be above the soil.

Staking and shading with coconut leaves, growing shade trees like banana is good in initial years of establishment.

Grafting Technique

About 3–4 months old seedlings raised in polybags can be used as rootstocks for grafting. Scion stick of 12–15 cm length with 2–3 buds from desirable high-yielders can be collected. Scion sticks of chupons (orthotropic) can be taken if seedling like architecture and lesser prning is preferred.

Rootstock stem and scion stick should be of the same thickness and physiological age. Grafting can be done by cutting the upper portion of rootstock with a grafting knife and making a vertical slit of 2–3 cm down (cleft).

Scion sticks being removed off leaves should be given a 'V' shaped slanting cut of 2–3 cm length (wedge) at the bottom. Grafting is done by inserting wedge into the cleft, tying tightly with a polythene tape of 1.5 cm wide and covering with small polythene pouch so that the graft joint and the scion stick do not dry up. It can be removed after 15–20 days. Perfect graft joint occurs in one month, polythene strip tied over the joint should be removed after 2 months and the successful graft becomes ready in 5–6 months for field planting.

The emerging shoots from the rootstocks should be removed. October–December is best for grafting. Grafts start yielding from second year onwards. Grafting pest and disease resistant clones on susceptible rootstock is an added advantage of this technique and old, unproductive plants can be rejuvenated through this technique by top-working. Conservation of multiple varieties on a single tree is also possible. High-yielding clones, I- 56, II- 67, III- 105 and NC 45/53, are being multiplied by soft wood grafting method and nearly 45,000 grafts/ year are supplied to farmers and developmental agencies.

Clonal Orchards and Production of F₁ Hybrids

The purpose of clonal orchard is to produce seeds of known parentage and proven performance in terms of high yield. The compatibility reactions shown by cocoa varieties are different to each other. Though seed is the cheapest and most convenient planting material in cocoa, open pollination results in larger variability. Therefore, based on the performance of earlier progeny trials the parents with best combining ability from the seed gardens are selected. These identified parents are multiplied vegetatively and planted in properly designed clonal gardens.

The self-incompatible female parent results in F₁ hybrids through cross-pollination or desirable crosses through hand-pollination (biclinal orchards). In a polyclonal orchard pollen parent is planted in ratio of one to five female parent trees and seed is collected only from the self-incompatible parent. These well-designed clonal orchards are being maintained by CPCRI, Regional Station, Vittal, at an isolated distance of more than 200m at CPCRI, Research Centre, Kidu, exclusively to prevent undesirable crosses and to produce genetically pure planting material which is not at all possible for any commercial planter to produce. High-yielding hybrids I-56 × II-67, II-67 × NC 29/66, II-67 × NC 42/94 are being produced from these gardens.

Nursery Diseases

Seedling dieback/ seedling blight caused by

Phytophthora palmivora is very common in cocoa nurseries of Kerala, Karnataka and Tamil Nadu during rainy season. Younger seedlings are more susceptible to diseases and severe infections observed in grafted and budded plants also. It initiates from the collar region, cotyledonary stalk or leaves as dark brown to black discoloration. It spreads to the entire stem causing wilting, defoliation and ultimate death of seedlings.

Foliar infection caused by *Colletotrichum gloeosporioides* is also common in almost all nurseries. Seedlings with infection look very unhealthy due to leaf blight, crinkling of leaves and stunted growth. White thread blight caused by *Marasmius scandens* leading to dieback of six months old seedlings has been reported as a problem in nurseries with high humidity, poor aeration and low

availability of sunlight. Zinc deficiency symptoms are also reported.

Remove and destroy infected seedlings from nursery. The disease incidence can be considerably reduced by improving the drainage facilities in nursery and by providing proper shade. Drenching the seedlings with Bordeaux mixture (1%) or copper oxychloride (0.2%) just before the onset of monsoon and thereafter at frequent intervals controls diseases.

For further interactions, please write to:

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Dr A.K. Singh Joins as Head, at IARI, New Delhi



DR A.K. Singh, has joined as Head, Division of Fruits and Horticultural Technology, IARI, New Delhi. Born on 1 January 1962, Dr Singh did B.Sc. (Agriculture) from Banaras Hindu University, Varanasi, in 1982-83. With an excellent academic record, Dr Singh pursued his M.Sc. (Hort.) and Ph.D. from IARI, New Delhi.

He was awarded "Mombusho Fellowship 1988-89", a prestigious Japanese Fellowship through Ministry of HRD, Government of India for further higher studies in Japan.

Since 2006, Dr Singh is working as a Consultant and Member-Secretary, National Task Force, Protection of Plant Varieties and Farmers' Right Authority, Ministry of Agriculture, Government of India. He has served many projects as a Principal Investigator successfully and developed DNA markers to differentiate zygotic seedlings of citrus species from nucellar seedlings. He identified a female sex associated DNA marker in dioecious pointed gourd. Due to which an early assessment of gender as well as easy understanding of molecular basis of sex determination in pointed gourd could be possible.

Earlier he has served Tata Energy Research Institute (TERI), New Delhi; IIVR, Varanasi and now IARI, New Delhi since the year 2000. Dr Singh's experience

Characterization of ber by using different molecular markers (AFLP, RAPD and ISSRs); detection of accession-specific amplified fragments for establishing a productive orchard with the help of primers to maintain quality of both scions and rootstocks; and spearheading mass propagation of horticultural crops through an innovative tissue culture technique are landmark research achievements of Dr. Singh in the field of research and development of horticultural crops.

as an Area Convener (Head), Division of Plant Tissue Culture, TERI, New Delhi, has been of immense importance in the field of horticulture, which proved him as a horticulturist of repute.

Dr Singh has more than 80 research, review and popular articles, and book chapters in various scientific journals, magazines, books etc. of national and international repute. At IARI, New Delhi, he has chaired a Core Group, to finalize the innovative research initiatives in fruits, vegetables and ornamentals. He has served as a member, Core Group, to develop Self-Learning Print Material for fruit nursery production at IGNOU, New Delhi. Nowadays, his main focus on research is to build, utilize and characterize genetic resources using conventional and molecular markers for research and conduct educational outreach in fruit crops.

-Som Dutt