

Review Article

AGE OF SEEDLING AT TRANSPLANTING IN COCONUT

K. SATYABALAN

*Central Plantation Crops Research Institute,
Kasaragod 670 124, Kerala, India.*

ABSTRACT

The age of coconut seedling at transplanting varies in different countries according to the prevailing practices and other conditions. It depends mainly on the ecological and climatic conditions in different countries and also in the different regions within each country. Young seedlings are planted in light soils like sandy soil, loamy soil, etc. whereas older seedlings are planted in heavy soils with high water table and also in areas which are likely to be affected by cyclones and hurricanes. It is also reported that in the case of older seedling while transplanting shock is greater and chances of mortality higher, the period of immaturity in the field is reduced. Another advantage of planting older seedlings is the lesser cost of maintaining these seedlings in a nursery than managing them in a plantation. In the case of young seedlings, selection on the basis of vigorous growth characters is difficult whereas in the case of older seedlings rigorous selection is possible. Thus there are merits and demerits in the practices followed by farmers in different countries. Research workers on coconut should consider and study all these aspects and recommend suitable practices to the farmers so that the time lag between planting and flowering of the seedlings as a result of transplanting shock is reduced to the minimum which will be of immense benefit to farmers of this economically important perennial crop.

Systematic selection of coconut seedlings for transplanting in the field has been practised in almost all the countries where coconut is grown. A study of the selection practices followed in various countries indicates that the age of seedling at transplanting varies from country to country and even from region to region within a country. The practices followed in some of the important coconut growing countries in the world and in the different coconut tracts in India are discussed in this review.

In Sri Lanka, as early as in 1923, Beven (1923) recommended that the

plants should have atleast four leaves at the time of planting out in the field. Seedlings are transplanted at one of the the three stages *viz.*, (1) as soon as the tip of the sprout appears through the husk or when the sprout is about an inch long; (2) when the sprout is 10-15 cm. long but before any green leaves have developed or any roots have entered the soil; (3) when the first two or three green leaves have developed. In the first stage no damage to the roots is done but it is difficult to say whether the subsequent seedling will be robust or weak, well developed or deformed. In the second also root damage is less

but no selection is possible. Only at the third stage selection is possible based on earliness of germination, vigour, sturdiness assessed by eye or by measurement. (Anonymous, 1951). Hence the recommendation is that they should be selected for transplanting when it has developed about three green leaves based on early germination, rapidity of growth, sturdiness, and freedom from 'legginess' and resistance to pests (Anonymous, 1971). In Malaysia, coconuts are grown on alluvial clays, clay loams and silts of deltaic and marine origin on the west coast whereas on the east coast, in parts of Penang and in a few localities they are grown on coastal sand. Here seedlings are planted in the field between 6 and 10 months after sowing in the nursery (Dickinson, 1958). In Indonesia, according to Singh (1958) the crop is at its best in places where the soil is not heavy. The best coconut producing areas are near the sea coast where ideal conditions for the crop are available. Here the best age of the seedling for planting is between 6 and 8 months since older seedlings from the nursery beds get damaged roots.

In the Philippines, as early as in 1922 Espino (Espino, 1922) recommended planting of 30 cm. tall seedlings since at that time the meat content of the nut is plentiful and the shoot and roots are short. Recent recommendation is that selection of seedlings should be done 3-5 months after setting them in the nursery when the seedlings develop 2-4 leaves. The criteria for selection are broad, dark green leaves, thick straight stem and absence of pests and diseases and other abnormalities such as

multiple shoots. Transplanting is usually done in about 6-10 months after setting of seednuts in the nursery (Anonymous, 1975).

In South Vietnam, coconut is cultivated in the alluvial deposits of Mekong and Bassac rivers. In the provinces of Bentre, Mytho and Vinhlong the palm is methodically cultivated. For raising seedlings, the selected seednuts are planted in wet light soil for germination. The seedlings are then transferred to a seed bed where they remain for about 12-15 months. When the seedlings attain a height of 0.80-1.20m they are transplanted. The seedlings are transplanted either with all the roots and earth sticking on to the roots, or after trimming the roots. The latter method is employed when the season is not too dry or the seedling has not sufficiently developed (Anonymous, 1958).

In Papua and New Guinea, the vigour of the seedling for transplanting is judged at four leaf stage based on girth at the base, size, spread and colour of the leaves, rapidity of growth and sturdiness of seedlings (Charles, 1959). In New Hebrides according to Fremond, Ziller and Lamothe, (1966) the plants are in the nursery for not more than four months when they are transplanted in the field.

In Fiji Islands, seedlings of 3-4 leaves in the nursery are generally selected for planting in the field (Satyabalan, 1976). The optimum time for transplanting seedlings from the nursery to the field in Solomon Islands is 4-5 months after germination or when the seedlings have produced a total of 3-5 leaves (Anonymous, 1967).

In the Caribbean and Central America, young seedlings of about 30–60 cm height are recommended for planting as they are found to be much better planting material than older and bigger seedlings and suffer less damage from wind. Young seedlings still have meat in seednut to supply them with food and water whilst they are establishing a feeding root system in the soil. Older seedlings suffer a greater transplanting shock because they rely on their roots which are usually damaged during lifting from the nursery (Romney, et al., 1968).

In West Africa, according to Fremond, et al., (1966) the seedling is considered good for planting at 6 months when it is about 80 cm tall. In Mauritius and its dependencies, the seednuts are planted in pits of 0.6–2.0 m deep depending on the site. The depth usually reaches the sub-soil water level through the reef crest. The seednut is placed at the bottom of the pit with the stalk and slightly slanting down so that the milk inside bathes the germinating core. As the sprout comes up, more humus and ash are gradually added to the pit leaving the sprout free to come up (Chatterjee, 1958).

In East Africa according to Acland (1971) coconut seedlings are ready for transplanting when they have 3 or 4 leaves, *i. e.*, about a year after planting.

In India, the age of seedling at transplanting varies from state to state and even from region to region within a state. In Kerala, the practice is to plant 10–12 month old seedling in the field during the beginning of South West Monsoon (Anonymous, 1952). Koyamu

and Albuquerque (1957) have reported that 4–6 months old seedlings are planted in some places in the west coast, during February–March months and this practice is in vogue in place where irrigation facilities exist. They have stated that in most places, it is ideal to plant one year old seedlings. In the reclaimed areas of former Travancore–Cochin State now part of Kerala State, shallow areas in the back-waters are enclosed with long bunds of ample width and height. Coconut seedlings which are 2–3 years old are planted on these bunds to serve the dual purpose of strengthening the bunds and getting additional income. The seedlings are planted in pits with sand, and as seedlings grow, sand is dumped in the inter-spaces. A mixture of sand and silt is ideal for the growth of the coconut palm.

In elevated sandy regions, older seedlings with 1–1.5 m. trunk formation are transplanted in deep pits. All the leaves except the central shoot and all the roots are cut and removed before the young tree is lowered into the planting pit. The tree is held in position with the aid of bamboo props and the pit is partially filled with manures and soil mixture. The pit is completely filled up in the course of the next two years. In Tamil Nadu, the age of seedling at transplanting differs from region to region. A practice of planting sprouted nuts known as 'Kakka mooku' (crow's beak) in the field was reported by John and Menon (1947). The same practice is followed in Edakkanad in Chingalpet district of Tamil Nadu also (Ibrahim and Ramanathan, 1959) where coconut industry is the main stay. Ripe nuts fallen from the trees are collected

at frequent intervals and kept in shade until they are almost devoid of water. They are sown in the nursery very closely. Seedlings are removed from the nursery in about 6 months after sowing for transplanting in the main field.

In Andhra Pradesh according to Kailasa Rao (1950) the practice in Uddhanam area, the coastal belt of coconuts, is to select about one year old seedlings for planting whereas in the irrigated tract of East and West Godavari districts, planting of seedlings of about $2\frac{1}{2}$ -3 year old is resorted to (Anonymous, 1955). One year old seedlings are transplanted 1.75 m apart in a second nursery. Three or four year old seedlings are selected for planting in the main field in order to save the trouble of putting up fences against cattle (Anonymous, 1955). Aiyangar and Das (1956) also described the method of double planting unique for the Godavari delta and planting of about one year old seedlings without selection in Uddhanam which is in contrast to the practices in Godavari delta. In Uddhanam, the Coastal belt of coconut in Srikakulam district of Andhra Pradesh, the nursery is raised in pure sand and under rainfed conditions. Naturally a large number of seedlings (even 40-50%) die. All the surviving one year old seedlings are planted in the field without selection. Though it is a rigid test of natural selection by survival of the fittest, it is no doubt a wasteful method. The nurseries in the irrigated tract of East and West Godavari districts of Andhra Pradesh are raised as aforesaid with irrigation until they are about one year old. At this

stage the seedlings locally called 'Sudha Pilaka' are planted in a secondary nursery where they are retained until about $2\frac{1}{2}$ -3 years old. Planting of such grown up seedlings is resorted to, as most of the coconut areas in Godavari district more or less experience water-logged conditions during rainy seasons. The farmers buy 1- $1\frac{1}{2}$ year old seedlings and plant them 5-6m apart in another nursery. They are kept there for three years till they develop good girth and attain a height of about 1.5m. Two year old seedlings are preferred for planting in these districts for the reason that these grow vigorously and are able to withstand water stagnation during the South-West monsoon. Under adverse conditions they thrive better than young seedlings. The cost of management of these seedlings in a restricted area is found to be less than that of planting and managing them in a regular plantation. When the seedlings attain a height of 1-1.5m they are lifted and planted in a permanent site. One disadvantage is that these seedlings cannot be packed and transported over long distances. The practice of transplanting one year old or just less than one year old seedlings purchased from the nurseries to a second nursery and retaining them for a year or two so as to reduce the cost of maintenance was reported by Hanumantha Rao (1957). This permits greater care in a limited area, reduces threat of cattle grazing and also gives the seedlings a good start when they are planted in the main field.

By planting 3-4 year old seedlings, it is believed that (1) the pre-bearing period is reduced, (2) the soil being

heavy and due to high rainfall the drainage posed a serious problem and establishment of aged seedlings under such conditions appeared to be comparatively better, (3) Only aged seedlings can be planted deeper in heavy soil with high water table and (4) the maintenance cost was reduced considerably by planting an aged seedling. Hence growers do not accept the recommendation of the Department of Agriculture to use one year old seedlings (Bhaskara Rao, 1970). According to Venkataratnam (1965) planters in alluvial deltaic soils of Godavari prefer seedlings aged two years and above for the reason that they grow vigorously and are able to withstand water stagnation during South West Monsoon season. He feels that by this double transplanting method the maintenance charges can be reduced and that 3-4 year old seedlings may come to bearing in four years after planting.

In Karnataka State the coconut gardens are concentrated in the maidan districts of Tumkur and Hassan. The coconut areas of Karnataka may be broadly divided into three distinct regions; (1) riparian tracts where gardens are located on the river banks and the soils are rich loams with high water table; (2) rainfed or dry tract where the water table is high and the gardens are mainly rainfed. The gardens in this tract are located in valley between the hills and (3) the coastal tract where gardens are located on the sea coast and the lower hill slopes in the South and North Kanara districts (Albuquerque, 1964). The soils are lateritic on lower hill slopes, red sandy loams in midlands and sandy in the coastal belt. In the

maidan tract it is the usual practice to plant 3-3½ years old seedlings locally called 'Gappe Sasi'. These newly planted seedlings are securely tied to supports. In other tracts seedlings of about one year old are used for planting. According to Mohamed (1958) the age of the seedling selected for planting in Pondicherry differs in the four regions of Pondicherry, Karaikal, Yanam and Mahe. In Mahe, one year old seedlings are preferred whereas in Pondicherry and Karaikal 3-6 months old seedlings are selected for planting. The reason for this is the belief that they withstand the cyclonic storms which are common during rainy months, better than older seedlings with profuse foliage. Farmers of Yanam prefer three year old seedlings as the older seedlings are more vigorous and withstand the heavy winds (Santhanakrishnan, 1960).

In Assam, seedlings of 8-9 months old are selected for planting (Majid, 1959). According to Nath (1963) best and big sized nuts are allowed to sprout under shade. The sprouted nuts are generally planted in the beds. Selection of seedlings is based on eye judgement. Although aged seedlings are preferred, smaller ones are also planted. In Laccadives 4-5 years old seedlings are planted fairly close to each other particularly in the interior parts of the islands (Menon, 1965). One year old seedlings are planted in a second nursery where they are kept for another 3-4 years and then planted out in the garden. After planting very little attention is paid to the seedlings.

According to Albuquerque (1955) there is no systematic planting from

seedlings raised in nurseries in Nicobar group of Andaman and Nicobar Islands. The nuts that drop in a garden are allowed to come up with the result that overcrowding has occurred in almost all the plantations. According to Singh (1964) in Nicobar, ripe nuts that fall on the soil germinate and turn into self sown trees. In Goa, usually one year old seedlings are planted out in the field (Satyabalan and Pillai, 1964).

Opinion vary widely on the age of seedlings at transplanting, the period varying from 3 to 16 months (Belfort and Hoyer, 1914). Copeland (1921) recommended transplanting young seedlings since transplanting aged seedling is likely to cause injury to the root system. Sampson (1923) described the advantages of planting seedlings at early stage and felt that it is impossible to fix the optimum age of seedlings at transplanting as this varies even within the same seed bed and also varies very much in different countries. Patel (1938) found that transplanting retarded growth of roots and felt that transplanting of old seedlings was undesirable. He has also stated that earlier transplanting is accompanied by less damage to the root system and ensures a quicker establishment of the seedlings but due to other considerations like white ant attack the seedlings should not be transplanted before they are one year old. Menon and Pandalai (1958) recommended that as a general rule under ordinary conditions, seedlings of 9-18 months old can be considered the best for transplanting in most places. According to Piggott (1964) under good conditions, the seedlings will be ready for transplanting when they are 12 months old. Though

older seedlings upto 3 years could be used, they are heavy to move and do not 'take' as good as young ones because the nut has no food reserves left. Child (1964, 1974) stated that transplants of 7-8 months should be the norm and that older plants should only be used under such special conditions as termite infestation. He has also recommended that at the transplantation stage when 3-4 leaves have developed a careful and stringent selection for robust plants should be made. According to Fremond et al., (1966) the duration of time the plant will spend in the nursery clearly depends on its rate of development. When a seedling shows a leaf splitting up into leaflets it should be transplanted, its chronological age varying according to ecological conditions. Given the choice, young seedlings rather than old are to be preferred as they establish themselves better (Fremond et al., 1966). Thampan (1981) considered the different practices and norms adopted by the major coconut growing countries and concluded that 6-9 month old seedlings should be preferred for transplanting under normal conditions, since at this stage the seedlings would have developed 3-5 fully opened leaves and a few roots with adequate availability of stored food in the nut. Charles (1968) from his studies felt that growth at an equal age after transplanting was probably more important than growth at an equal age after nursery planting and reported that the retardation in growth was not as great as the growth made during the extra period in the nursery.

There are merits and demerits in the practices followed by farmers in

different countries. Research workers on coconut should therefore consider and study all these aspects and recommend suitable practices to the farmers so that the time lag between planting and

flowering of the seedlings as a result of transplanting shock is reduced to the minimum, which will be of immense benefit to farmers of this economically important perennial crop.

REFERENCES

- ACLAND, J. D. 1971. Coconuts (*Cocos nucifera*) Chapter 10: pp 49-56. In *East African Crops*. Longman Group Ltd. London.
- AIYANGAR, G. S. and DAS, T. N. 1956. Cultural practices in coconut and scope for their improvement in Andhra. *Bull. Indian Cent. Coconut Committee*. 10: 37-39.
- ALBUQUERQUE, S. D. S. 1955. Coconuts. The Wealth of Car Nicobar. *Bull. Indian Cent. Coconut Committee*. 9: 71-75 and 78.
- ALBUQUERQUE, S. D. S. 1964. Coconut cultivation in Mysore. *Coconut Bull.* 18: 249-256.
- ANONYMOUS. 1951. Nursery management and selection of seedlings. *Leaflet No. 2*. Coconut Research Institute, Ceylon.
- ANONYMOUS. 1952. Planting of coconut seedlings. Different regional practices. *Bull. Indian Cent. Coconut Committee*. 6: 39-42.
- ANONYMOUS. 1955. Coconut cultivation in the Godavari Districts. *Bull. Indian Cent. Coconut Committee*. 8: 241-243 and 274-275.
- ANONYMOUS. 1958. The coconut palm in South Vietnam. *Coconut Bull.* 12: 267-269.
- ANONYMOUS. 1967. Coconut research in the British Solomon Islands. *Ext. Pamphlet 10/67*. Dept. of Agri. B.S.I.P. 1-33.
- ANONYMOUS. 1971. Nursery management and selection of seedlings. *Leaflet No. 2*. Revised Edition. Coconut Research Institute, Ceylon.
- ANONYMOUS. 1975. *The Philippines recommends for Coconut 1975*. 1-63. Philippine Council for Agriculture and Resources Research.
- BELFORT, R. and HOYER A. T. 1914. *All About Coconuts*. The St. Catherine Press, London.
- BEVEN, A. K. 1923. *Ferguson's All About The Coconut Palm (Cocos nucifera)*. Fifth Edn. Coconut Planter's Manual. Ceylon Observer Press, Colombo.
- BHASKARA RAO, K. 1970. Why this practice of planting aged coconut seedlings in Godavari and Krishna Deltas? *Coconut Bull.* 1 (6): 3.
- CHARLES, A. E. 1959. Nursery selection of coconut seedlings. *Papua and New Guinea Agri. J.* 12: 116-118.
- CHARLES, A. E. 1968. Report on coconut establishment trial, in New Guinea. Third FAO Tech. Wkg. Party. Cocon. Prod. Prot. and Processg. Jogjakartha, Indonesia (CP/68/19)
- CHATTERJEE, B. 1958. Coconut cultivation in Mauritius and its dependencies. *Coconut Bull.* 12: 205-209.
- CHILD, R. 1964. *Coconut*. Longmans Green and Co. Ltd., London.
- CHILD, R. 1974. *Coconuts*. Second Edition, Longman Group Ltd., London.
- COPELAND, E. B. 1921. *The Coconut*. Macmillan and Co. Ltd., London.
- DICKINSON, T. R. 1958. Coconut cultivation in Malaya. *Coconut Bull.* 12: 177-181.
- ESPINO, R. B. 1922. On the germination of coconuts. *Philipp. Agric.* 11: 191-200.
- FREMOND, Y., ZILLER, R. and NUCE de LAMOTHE M. 1966. *The Coconut Palm*. International Potash Institute, Berne/Switzerland.
- HANUMANTHA RAO, C. 1957. Growing coconuts in coastal Andhra. *Coconut Bull.* 11: 143-151.
- IBRAHIM, P. A. M. and RAMANATHAN, T. 1959. Coconut industry in Edakkanad in Chingalpet District. *Coconut Bull.* 13: 78-84.

- JOHN C. M. and MENON, K. P. V. 1947. Joint report of the Oil Seeds Specialist, Coimbatore and Plant Pathologist-Officer deputed to the Indian Central Coconut Committee for the examination of work done on the improvement of coconut in the Provinces and States and report on future lines of work. Govt. Press, Madras.
- KAILASA RAO, T. 1953. Coconut nursery practices in Andhra Pradesh. *Coconut Bull.* 7: 43-47.
- KOYAMU, K. and ALBUQUERQUE, S. D. S. 1957. Hints on the age of planting and spacing of coconut seedlings. *Coconut Bull.* 11: 11-12 and 21.
- MAJID, S. 1959. Prospects of coconut cultivation in the Assam. *Coconut Bull.* 13: 159-165.
- MENON, K. P. V. and PANDALAI, K. M. 1960. *The Coconut Palm—A Monograph*. Indian Central Coconut Committee, Ernakulam. pp. 384.
- MENON, K. S. 1965. Coconut cultivation in Laccadives. *Coconut Bull.* 19: 211-213.
- MOHAMMED, P. P. S. 1958. Coconut cultivation in Pondicherry State. *Coconut Bull.* 12: 299-302.
- NATH, P. R. 1963. Coconut Development and Research in Assam. *Coconut Bull.* 17: 247-252.
- PATEL, J. S. 1938. *The Coconut—A Monograph*. Govt. Press, Madras. pp. 313.
- PIGGOTT, C. J. 1964. *Coconut Growing*. Oxford University Press, London. pp. 103.
- ROMNEY, D. H., WHITEHEAD R. A., SMITH, R. W. and SHAW F. D. 1968. *How to grow better coconuts. A Hand Book for Coconut Growers in the Caribbean and Central America*. FAO UNFL IC/5.
- SAMPSON, H. C. 1923. *The Coconut Palm*. John BaleSons and Daniels Sons Ltd., London.
- SANTHANAKRISHNAN, B. 1960. Coconut cultivation in Yanam. *Coconut Bull.* 14: 185-186.
- SATYABALAN, K. 1976. Coconut growing in Fiji Islands. *Coconut Bull.* 7: 1-4.
- SATYABALAN, K. and PILLAI, R. V. 1964. Goa can grow more coconuts. *Coconut Bull.* 18: 333-338.
- SINGH, M. B. 1958. Coconuts in Indonesia. *Coconut Bull.* 12: 174-176 and 182.
- SINGH, J. 1964. Coconuts in the Andamans and Nicobars. *Coconut Bull.* 18: 390-397.
- THAMPAN, P. K. 1981. *Hand Book on Coconut Palm*. Oxford and IBH Publishing Co., New Delhi. pp. 302.
- VENKATARATNAM, L. 1965. Second nursery coconut seedlings have advantages. *Coconut Bull.* 18: 417-449.