Coconut Planting and After Care

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Coconut is a tropical crop and hence grows well in a hot climate.

Coconut thrives well within a latitude of 23 degrees of the equator (Between 20ºN and 20ºS latitudes) and an altitude upto 600 m above mean sea level. Temperature is one of the most important weather factors that has large influence on the growth and productivity of coconut. The coconut plants well adapted to a less diurnal variation between day and night temperatures and it does not withstand extreme temperatures. The range of temperature should be between 20° to 32°C, with a mean annual temperature of 27°C for better growth and yield. There may be reduction in yield when the mean temperature drop below 21°C. At the same time high temperature may also cause drying of developing inflorescences, and lead to decreased production especially in those months in the year.

The palm requires copiousness of sunlight and does not grow healthy under shade or in cloudy conditions hence should not be planted near heavy shade trees. Cloudiness seize the rate of transpiration. Coconut palms prefer bright sunshine and about 2000 hrs of sunshine in a year is required for the healthy growth of the palm. Coconut is grown in a wide variety of soils ranging from pure sand to clay and from moderately acidic to alkaline soil. Among that red sandy loam, coastal sandy, laterite and alluvial soils are more suitable. Heavy soils which lacks drainage facility are unsuitable for coconut cultivation. In areas with heavy rainfall, well drained soils and in low rainfall areas fine soils having good water holding capacity are more suitable for better growth of the plant. The ideal mean temperature is 27°C with 5-7° diurnal variation. A well distributed annual rainfall of 1300-2300 mm is ideal for the growth of coconut. To get good bearing coconut trees the farmer must be careful right from the planting stage. Coconut seedlings which are not correctly planted will bear late and may even die prematurely.

Land preparation

Land preparation for coconut planting should be based on the topography and the soil type. If the land

is too sloppy, suitable soil and water conservation methods should be adopted before planting. If water table is high mound planting can be followed. The land preparation includes the cutting and removing the logs and stumps, weeding and measures to control pests. The best time of planting of coconut seedling is along with the onset of pre monsoon showers. But if there is proper irrigation facility the planting can be done during summer months also.

The nature of preparation of land before planting depends upon slope of land, soil type and other environmental factors. The area should be cleaned and planting holes need to be marked out at appropriate places. If the land is slopy, soil conservation methods should be adopted. If the groundwater level is high planting may be taken up in the mounds. On slopes and in areas of undulating terrain, prepare the land by contour terracing or bunding. In low-lying areas and rice fields, form mounds to a height of at least 1m above water level. In reclaimed kayal/lake areas, planting can be done on the field bunds.

For raising nursery well-drained, coarse-textured soil with irrigation water facility should be selected. If there is no drainage problem the seed nuts can be sown in flat beds. In case of water stagnation problem is existing, raised beds are to be preferred. Nursery can be raised either in the open condition with artificial shade or in gardens where the tall palms are there to give enough shade. The seed nuts should be sown at a spacing of 40 cm x 30 cm during May-June in long and narrow beds, either horizontally or vertically in 20-25 cm deep trenches. Vertical planting has an added advantage of less damage during transit of seedling. On the other hand, in case of delayed planting, if the nut water goes down significantly, take up horizontal sowing. It is better to go for horizontal sowing of seed nuts for improved germination.

Transplanting of the seedlings can be done with the onset of monsoon season. The age of the seedling should be 8-10 months. Usually eight month old seedlings give a better insight for their growth and development. When the seedlings are too young, it is easy to see the difference in vigour between seedlings. In the case of polybag seedlings, first the polybags are to removed during transplanting. The top of the seed nut should be 5-8 cm below ground level. Deep planting will hinder the bud to come out and shallow planting may lead to the bending of planting material during heavy rains or windy days. There should be a slight depression towards the base of the crown to trap rain water.

Spacing and planting geometry

▶ *Planting Systems*

The spacing of planting may differ according to the type of cropping. Palms are planted at a spacing that allows the tips of horizontally held mature leaves to touch each other. The spacing between the plants is about 7-8 m for dwarf palms, 8-8.5 m for hybrids and 9-10 m for tall palms. This is because the crown size of tall palms are about 30% larger than hybrid and Dwarf varieties. This may result in the yield of about 115-236 palms/ha under triangle system, or 100-200 palms/ha under square system. In case of the same distance of planting, the triangular system can accommodate 15% more palms than the square system. As a guide, Table 1 shows the population and planting density under typical square and triangular systems of planting

Table -1

Sl No	System	Spacing
1	Triangular	7.6m
2	Square	7.6x7.6m, 8x8m, 9x9 m
3	Single Hedge	6.5m in rows - 9m between rows
4	Double Hedge	6.5 to 6.5m in rows - 9m between pairs of row

For getting superior yield from coconut, optimum plant density must be maintained in the field in such a way that there should be sufficient sunlight falling on coconut leaves during the growth phase and avoid excessive shading. A spacing of 7.6 m x 7.6 m to 8.0 m x 8.0 m in the square system is normally recommended for coconut. This will hold 177 and 156 palms per ha, respectively. If the triangular system is adopted, an extra 25 palms can be planted. Hedge system can also be adopted giving a spacing of 6.5 m along the rows and 9.5 m between rows. For facilitating multiple or intercropping in coconut gardens, it is advisable to go for wider spacing of 10 m x 10 m so as to make available liberal opportunity to house a number of perennial and annual crops in the inter spaces.

Table -2		
SPACING	POPULATION DENSITY (palms/ha)	
	SQUARE METHOD	TRIANGULAR METHOD
7.6 m x 7.6 m	177	198
8m x 8m	156	180
8.5 m x 8.5 m	138	160
9m x 9m	134	143

10 m x 10 m	100	115

For cultivating coconut on slopes and in areas of undulating topography, get ready the land by contour terracing or bunding. In low-lying areas or valley bottoms, mounds are to be prepared at planting site to a height of at least 1 m above water level. In reclaimed lands, seedlings are to be planted on field bunds. In case of loamy soils with low water table, the pit size should be 1mx1mx1m. In case of laterite soils with underlying bedrocks, make larger pits of size 1.2 m x 1.2 m x 1.2 m. In areas with sandy soils texture, the size of pit should not beyond 0.75 m x 0.75 m x 0.75 m. In case of well drained soils, seedlings can be transplanted with the commencement of rain. In case of low lying areas subject to flood during monsoon periods, it is advisable to plant the seedlings after the end of the monsoon.

Pit making and planting

Land preparation for planting coconut depends to a great extent on soil type and environmental factors. If the land is not leveled and full of shrubs, the shrubs have to be cleared and land should be leveled before digging pits. The depth of pits will depend upon the type of soil. In case of laterite soil with rocky substratum, deeper and wider pits, 1.5 m length x 1.5 m breadth x 1.2 m depth may be dug and filled up with loose soil, powdered cow dung and ash up to a depth of 60 cm before planting. In such soils it is recommended to add 2 kg of common salt to loosen the soil. In case of loamy soils with low water table, pit size of 1 m x 1 m x 1 m filled with top soil to height of 50 cm is generally recommended. At the centre of the pit make small hole and plant the

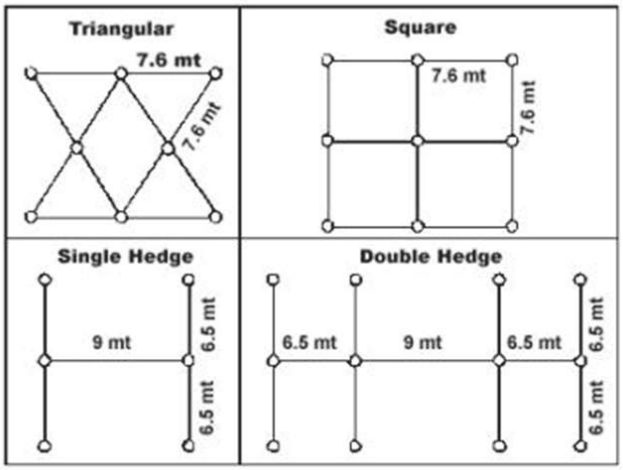

Fig. 1. The different systems of planting of coconut

coconut seedlings and the soil around the seedlings must be tightly pressed, but soil should not be allowed to bury the collar region of the seedling or enter into the leaf axils. If the water table is high, planting at the surface or even on mounds may be required. Although planting on the surface or mounds, digging pits and soil filling also have to be done. In case of filling the pits with soil, it is suitable to use top soil. At least two layers of coconut husk (with concave surface facing up) can be arranged at the bottom of the pit before filling up the pit. This will ensure the moisture conservation. In areas with littoral sandy soils application of 0.15m^3 red earth is recommended to improve the physical condition of the soil. In area with water logging, ensure proper drainage by making drainage channels.

Planting of seedling along with the onset of monsoon is recommend for the rapid establishment

Table 3: General fertilizer recommendation for coconut (g/palm)						
Age of coconut palm	May-June /September- October			May-June /September- October		
	N	P2O5	K2O	N	P2O5	K2O
First year	Planting in May - June			110	200	225
Second Year	110	200	225	240	400	450
Third Year	240	400	450	480	800	900
Fourth year onwards	370	600	670	715	1000	1330

of the plant in the main field. Rapid growth of the palms occurs during the first five years of planting in main field. The stem portion will be visible after growing 3-4 years and there will be 30-50 cm annual elongation of stem occurs during this period. In older palms the stem elongation process is slower compared to seedlings. At the extent of vegetative growth, the young trees produces nuts and it took 2-3 years to become stable in nut production.

Management of juvenile palms

Good care should be taken all through the early years of growth of young palms for getting high yield. After field planting staking has to be done to protect the seedlings from heavy wind and provide proper shading using plaited coconut leaves or any other suitable shading materials to protect from bright sunlight. Juvenile palms need sufficient moisture, at the same time they can not withstand water logging condition also. Hence care should be taken to avoid planting in lands prone to water logging. Field planted seedlings should be given adequate irrigation during the summer months. Irrigation using 45 litres of water once in 4 days has been found suitable in all soil types. If following drip irrigation, daily 10 litres of water should be provided. Proper drainage should be provided in areas prone to water stagnation. Weeding of the pits should done periodically. Washed down soil covering the collar region of the seedlings during the heavy rains should also be removed. Widening of the pits should be done each year prior to the application of manure. As the seedlings grow the pits should be gradually filled up with soil. A basin radius of 1.8 m from the trunk of the palm could be fully prepared by the fourth year. Insect and disease attach to the palms should be regularly monitored and required corrective measures should be taken up on time.

Under planting

Under planting (the term used for removing old trees and planting new seedlings) is done in plantations where the palms have become unproductive and uneconomic to the farmer. Very old palms are removed in stage wise over a period of 3 to 4 years. First the area underplanted is to be peg marked. At the outset, very poor yielders (less than 20 nuts per palm per year) and those trees which are very near to the peg marked point for underplanting are to be removed. Other palms are to be removed at the rate of one third each year during 2nd, 3rd and 4th year after underplanting. In the case of existing gardens if the plants are irregularly spaced, older palms within 1 m radial distance from the newly planted seedlings are to be removed in the first year of underplanting, two metre distance in the second year, three metre distance in the third year and the remaining ones in the fourth year.

Manuring

▶ *Nutrient requirement*

From the first year of planting onwards regular manuring is essential for good vegetative growth, early flowering and timely bearing and high yield of coconut palms. It is always recommended to test soil in the coconut garden (once in 3 years) and based on these results the type and rate of chemical fertilizers can be decided. In the main field, three months after planting, it is recommended to apply chemical fertilizers at the rate of one tenth of the recommended quantity of fertilizer for adult palms. This will be one third of the amount recommended for adult palms in the second year and apply in two split doses along with the start of rain.Twice the quantity of second year dose may be applied in third year as shown in Table 3. From fourth year fertilizers may be applied at the recommended rate for adult palms. In India, the general recommended dose of fertilizer per palm per year is at the rate of 500 g N, 320 g P2O5 and 1200 g K2O for adult plantations. To provide the above amount of nutrients for an adult palm, it is required to use about 1.1 kg urea, 1.5 kg rock phosphate (in acidic soil) or 2 kg super phosphate (in other soils) and 2 kg of muriate of potash (MOP). It can also be supplied through 700 g Di ammonium phosphate (DAP), 815 g of Urea and 2 kg of MOP.

Time and method of fertilizer application

The chemical fertilizers are applied in such a way that after the summer showers received, during May-June, 1/3rd of the suggested quantity of fertilizers may be distributed around the palm basins radius of 1.8 m and forked in. During August-September, prepare circular basins of 1.8 m radius at a depth of 20 cm and green leaf or compost or farm yard manure may be spread at the rate of 50 kg per palm basin. The leftover 2/3rd of the recommended amount of fertilizers may be spread on the green leaf or compost and covered. In places where irrigation facilities are available, it is appropriate to go for more number of split doses, as far as possible four split doses are suggested (March, June, September and December).

Besides the above fertilizers dose,one kg of finally ground dolomite or lime stone and 0.5 kg Magnesium sulphate should be applied per palm per year is recommended for acidic soils as well as light sandy soils. The dolomite/lime may be applied prior to the commencement of monsoon rain in the coconut basins and forked in. Care should be taken that liming materials should not be applied along with other chemical fertilizers. But magnesium sulphate can be applied along with other fertilizers. In case of laterite soils, 50 per cent of the K2O requirement of coconut can be substituted by Na2O supplied in the form of sodium chloride. Judicious application of micronutrients on the basis of soil test values, it is recommended to apply borax 120 g per palm in four equal split especially based on the intensity of deficiency symptoms.

▶ *Drip fertigation*

Wherever drip irrigation is available, it is possible to use soluble fertilizers like urea, Di ammonium phosphate, phosphoric acid (commercial grade) and muriate of potash along with drip irrigation in six equal split doses. Through fertigation, it is suggested to give 91 g urea, 33 ml phosphoric acid and 170 g muriate of potash per palm per application. If Di ammonimum phosphate is giving, it is advisable to give 70 g urea, 60 g DAP and 170 g muriate of potash for each dose per palm.

▶ *Organic manures*

Sufficient quantity of organic manure should be supplied to improve the soil quality and recycling of nutrients to coconut palms. Besides, organic manures aids in improving soil microbial activity and recycling of nutrients. Organic manures including compost, farm yard manure, green leaf manure or vermi compost can be applied to coconut palms. It is recommended to apply 10 kg/palm organic manure as compost or vermi compost or farmyard manure six months after planting in the main field. In the second year it can be increased to 20 kg per palm; in the third year the dose may be increased to 30 kg per palm and in the fourth year organic manure applied should be increased to 40 kg per palm. From fifth year onwards the dose may be fixed as 50 kg organic manure per palm per year. Coir pith compost (coir pith, poultry manure and lime and rock phosphate along with fresh glyricidia leaves /tender stem)can also be used as an enriched organic manure. Organic manures are applied during August-September in circular basins of 1.8 m radius and 20 cm depth. The recommended amount of organic manures may be spread in the entire basin.

Crop waste recycling

Organic manuring enhances physical, chemical and biological properties of the soil and hence a good organic base is important for the proper absorption of nutrients. Biomass like coconut leaves, spathe, bunch waste, husk of nuts etc are available from the coconut garden. Biomass from other annuals and perennials grown as inter or mixed crops in the garden can be recycled along with the coconut wastes. In the case of integrated system, the animal component may provide nutrient rich biomass from the system itself. The decomposition of these natural organic material will results slow nutrient release throughout year.

Irrigation management

As far as coconut cultivation is considered, moisture is the most limiting factor for nut production. In areas where long period of dry spells or ill distributed or scanty rainfall is prevailing irrigation is very much necessary to maintain the yield. Hence,

during summer months irrigate the palms in the basin area at a radius of 1.8 m and depth of 10-20 cm. According to climate and soil type, the water requirement of the palms may vary. In coconut, immediately after the juvenile phase the growth and reproductive stages simultaneously occurs and hence the palms require readily available moisture throughout their life cycle. The water requirement of coconut seedlings was about 1.591 and 1.533 mm per year when irrigation was given at 80-100% and 60-100% respectively. In the case of young palms upto first three years the water requirement was very low as the leaves are small. An adult palm requires around 600-800 litres of water once in 4-7 days. Care should be taken that the seedlings and young palms should not be irrigated with sea water. Hence, once the irrigation is started it is recommended to follow systematic and regular irrigation.

Methods of irrigation

The most common irrigation methods in coconut gardens are flooding, basin irrigation, sprinkler or perfo-sprays and drip irrigation. There is a remarkable wastage of irrigation water in case of flood irrigation. Besides, it results in poor aeration especially in clayey soils and leads to water stagnation and it may lead to the spread of soil born pathogen causing Ganoderma like diseases. Therefore, flood irrigation is not a suitable irrigation method for coconut and if possible it should be avoided. In the case of basin irrigation, water is provided in the basins of coconut through irrigation channels. Main irrigation channels are made between the two rows and sub channels are prepared to connects each basin. This type of irrigation also causes minor losses of water by way of deep percolation, seepage and evaporation. But this loss will be minimum if the basins are irrigated with hose pipes. Using hose pipes helps to bring down water loss during transport.

Conclusion

Proper planting of seedlings, nutrient and irrigation management practices etc are the key factors to raise the coconut plants successfully. From the point of selection of nuts for seedling production to the establishment of adult palm are very important and care should be taken in each step to have good yielding palms. Management practices are very important and should be followed as per the instructions to maintain the growth and yield of the palm. ■