UNIT 17 CULTURAL PRACTICES AND NUTRIENT MANAGEMENT OF COCONUT

Structure

17.0 OBJECTIVES

After studying this unit, you should be able to:

- describe the coconut botanically and identify varieties, soil and climatic requirements;
- explain nursery practices, land preparation and sowing;
- discuss field planting and management practices like shading, weeding and nutrient and water management; and
- explain intercropping and mixed cropping systems.

17.1 INTRODUCTION

Dear learner, you are perhaps aware that the coconut palm popularly known as 'Kalpa Vriksha' or 'Tree of Heaven', is of great antiquity in India. Every part of the tree is useful to man-hence the popular name-and it provides livelihood for millions of people in the country and elsewhere. Details on area and production statistics are available in Unit 1 of Course 1. The copra produced from kernel has 60 to 70 per cent oil which is one of the richest sources of vegetable oils. Coconut oil is widely used as cooking oil and also for various industrial purposes. The protein rich coconut milk and tender coconut water are popular food and drink materials. Toddy obtained by tapping the inflorescence, is an invigorating drink. Mature coconut trunk is a durable wood used for a variety of purposes including furniture making. Coconut fibre from the husk is valued for its elasticity and resistance to mechanical wear and dampness. By-products of coir industry such as pith and fibre dust are useful for improving soil health and conserving moisture. The shell is an important source for producing charcoal and activated carbon. The leaf is useful for thatching.

In this unit, we propose to study the botanical aspects of this species, its centre of origin, climatic and soil requirements and its present distribution in the world and in India. Following these, we deal with cultural operations of the crop starting with seed nut collection and nursery practices and proceed up to field planting and practices like shading, weeding and nutrient and water management. Some aspects of intercropping in coconut gardens also will be covered. It will end up with an estimated yield level of coconut under good management.

17.2 ORIGIN AND DISTRIBUTION, CLIMATIC AND SOIL REQUIREMENTS

Coconut is one of the most widely cultivated palms distributed in the warm humid tropical situations. However, this is mostly confined to the coastal areas as well as in different soil types both under rainfed and irrigated conditions.

17.2.1 Origin and distribution

Coconut is a crop that is considered to have originated in South-east Asia or the Pacific Islands from where it had been transported to other regions either by man or naturally by sea currents. At present, this crop is cultivated in 93 countries of the tropical belt in the latitude range of 23° N and 23° S. The major countries cultivating coconut are India, Indonesia, Philippines, Sri Lanka, Malaysia, Thailand, Papua New Guinea and Fiji. India, Indonesia, Philippines and Sri Lanka account for 81 per cent of the area and production. India presently is the largest producer of coconut in the world accounting for 15.5 per cent of the area and 27 per cent of the world production. India is also ahead of other countries in productivity.

In India, coconut is cultivated in 17 states and three Union Territories. Of these, 90 per cent of the area and 89 per cent of the production of the country are from the four states Kerala, Tamil Nadu, Karnataka and Andhra Pradesh in this order. The area under coconut is 1.93 million hectares and the annual production

is 15.84 billion nuts. While in the coastal state of Kerala, coconut is grown all over, it was primarily concentrated in the coastal belts in the remaining three states. However, in Karnataka and Tamil Nadu the crop is now being cultivated in interior areas where irrigation facility exists. Though Kerala leads in area (47 per cent) and production (46 per cent), its productivity is less compared to other three states due to various unfavourable factors like diseases. We have discussed these aspects in detail in Unit 1 of Course 1.

17.2.2 Climatic and soil requirements

Climatic requirements: Coconut is basically a tropical tree requiring equitable climate, bright sunshine, fairly high humidity and a well distributed rainfall of 100 cm and above. It can grow up to an elevation of 1000 m above MSL. Cold and frosty climates are not suitable for the crop. Though it cannot stand drought for long periods under the climatic situations of Kerala where monsoon rains follow a bimodal pattern with four to five rainless months in a year, coconut survives without irrigation. Grown up coconut can also withstand water stagnation for longer periods. In areas other than Kerala, the west coast of Karnataka and Goa, coconut has to be grown necessarily as an irrigated crop.

Soil requirements: Coconut does best in relatively coarser textured soils likes sandy loams, sandy coastal alluviums and sandy river valleys. It is found to grow well on littoral (coastal) sand which is generally unsuitable for many other crops provided it is managed carefully in the early stages with organic manuring and watering. In Kerala, it is cultivated in nearly all the soils, the dominanbeing laterite, lateratic, red and alluvial soils. Elsewhere, the rang is wider and fine textured clayey soils are also put for the cultivation of coconut. In all types of soils, one basic requirement is a minimum 2.0 m soil depth.

17.3 BOTANY AND VARIETIES

Coconut is a perennial monocot belonging to the family Arecaceae. Its botanical name is *Cocos nucifera L.* It is a tall, unbranched tree with a terminal crown of leaves, growing up to a height of 20-30 m and lives for 80 to 100 years. Based on stature, coconut is broadly grouped into 'Tall' and 'Dwarf' types. Some of the important tall varieties are West Coast Tall, East Coast Tall, Andaman Ordinary and Lakshadweep Ordinary, Cochin China, Phillippines etc. The popular dwarf varieties are Chawghat Green Dwarf, Chawghat Orange Dwarf, Malayan Yellow Dwarf, Malayan Orange Dwarf and Malayan Green Dwarf. Tall varieties constitute the coconut of commercial importance and are widely grown in all countries. These yield for over 60-70 years and are generally cross pollinated and hence, show variation in plant and nut characters. Dwarf types are mostly self pollinated and available in three shades-green, yellow and orange. These palms flower early, yield for about 20-30 years and grow up to 15-20 m. Copra from the Dwarf types is inferior to that of Tall types and is less preferred for domestic consumption. Dwarf varieties are good as tender nuts and for ornamental purposes. In this unit, only tall varieties of coconut are considered for discussing various aspects though they are almost identical for dwarf types too.

Mother Palm Selection: Tall coconut shows considerable variability in all the characters including yield. As such, selection of mother palms and seed nuts are important to produce quality planting materials. This is done adopting certain selection criteria. Some of these criteria being followed for tall types are to select palms having:

- Regular yielding habit and a yield of not less than 80 nuts/year/palm.
- Age of 20 years or more. This is to observe the yield characters for at least five years after reaching steady bearing.
- More than 30 fully opened leaves with short, strong petioles and wide leaf base firmly attached to the stem.
- Bearing at least 12 bunches with strong bunch stalks.
- Bearing nuts of medium size and of oblong shape.
- Husked nuts to weigh not less than 600 g.
- Mean copra content to be more than 150 g.

Avoid palms showing high percentage of barren nuts, shedding of immature nuts and those growing under abnormally favourable conditions.

An improvement over the above procedure is identifying what are called pre-potent palms. Pre-potent palms are those having the above desirable characters and are also known to transmit these characters to the progeny better. Such palms have been identified in research stations but it may also be possible for farmers to do so provided there is continued observations taken over a sufficiently long period.

A further improvement in the production of superior planting material is the production of hybrids of tall and dwarf types. Some of the hybrids released for cultivation are given along with their parents : Lakshaganga (Lakshadweep Ordinary × Gangabondam), Anandaganga (Andaman Ordinary × Gangabondam), Keraganga (West Cost Tall × Gangabondam), Chandrasankara (Chawghat Orange Dwarf × West Coast Tall), Kerasree (West Coast Tall × Malayan Yellow Dwarf), etc., The hybrids are also broadly indicated as D × T and T × D, the first letter standing for the female parent. However, the overall performance of these hybrids is not sufficiently encouraging as a number of them exhibit few of the less acceptable features like thin kernel, weak fronts (leaf stalk), bunch buckling etc., of the dwarf types.

For Root (wilt) disease affected areas, it is recommended to use seedlings raised from high-yielding apparently healthy palms present in the severely root wilt infected areas and that do not show symptoms of the disease. Still better, hybrids of apparently healthy palms may be used. Though it may be difficult to produce such hybrids at the farmers' level, limited numbers are now being produced in some of the research stations located in the diseased areas of Kerala.

? Check Your Progress 1

Note: a) Use the space below for writing your answers.

b) Compare your answers with those given at the end of this unit.

1) Which are the major coconut producing states of India?

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2) Give the minimum soil depth required for the good growth of coconut.

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3) Give the botanical name of coconut and the family that it belongs to:

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4) Name three coconut hybrids recommended for cultivation.

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17.4 NURSERY AND SOWING

Since coconut is a perennial crop, utmost care should be given in the production of quality planting materials and their proper establishment in the plantation. It normally takes about 10 to 12 years for a palm to reach steady bearing stage. Hence, any mistake in seedling selection will end up in loss of time and inputs. There are no other alternative methods of propagation either.

***Collection and storage of seed nuts*:** Seed nuts are to be collected from selected mother palms by lowering the bunches with rope especially where the field is hard. These may be stored under shade arranging the nuts with the stalk end up. Up to three layers of nuts can thus be stored arranging them one over the other with sand filling the interspaces. Seed nuts may also be stored in the field provided the soil is sandy and the area sufficiently shaded. Sowing in the nursery is to be done 10 to 12 months before the expected planting date. For the climate of Kerala, seed nuts may best be collected during the peak bearing period from December-January to March-April and sowing to be done in May-June.

Selection and preparation of site for nursery: The site for nursery should be well drained and the soil should be light textured. It should have about 50 per cent shade. Beds for raising nursery are to be made with a width of 1.5 m and of required length with a space of 75 cm between beds. Where drainage is poor the beds should be raised to the required level.

Sowing seed nuts: Before sowing, examine the seed nuts and discard the damaged ones. Sowing of seed nuts is to be done in 30 cm deep trenches formed in the bed keeping the distance between nuts at 30 cm. The nuts may be sown either vertically or horizontally. When following the latter, the widest segment of the nut should face up.

Care and management of nursery: Irrigate the nursery once in two days during the rain-free period and keep the nursery free of weeds. It is desirable to mulch after the cessation of rain. Protect the plants against termite attack if it is noticed, by using insecticides. Remove the seed nuts that do not germinate within six months of sowing. It is found that early bearing and high yield of coconut are related to seedling characters and as such, selection of seedlings in the nursery through elimination of 35 to 40 per cent of germinated but weak and abnormal seedlings and ungerminated seed nuts, will be a desirable practice. The criteria for selection of 9 to 12 months old vigorous seedlings for planting are given below:

- Early germination, rapid growth and seedling vigour.
- Six to eight leaves for 10-12 months old seedlings and at least four leaves for nine months old seedlings.
- Collar girth of 10-12 cm.
- Early splitting of leaves.

17.5 PREPARATION OF LAND AND PLANTING OF SEEDLINGS

The nature of preparation of land before planting depends on topography of land, soil type and other environmental factors. 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.

The size of pits for planting would depend on soil type and water table. In loamy soils with low water table, pit size of 1m × 1m × 1m is recommended. In laterite soils with laterite rock below, larger pits of 1.2 m × 1.2 m × 1.2 m are recommended. In sandy soils, pit size may be 0.75 m × 0.75 m × 0.75 m. These pits are to be refilled with top soil to a height of 60 cm below the ground level. As the seedlings grow and develop the stem, fill up the pits gradually by cutting in the sides. This may be continued up to the fifth year when a basin of about 2 m radius will be formed around the stem. In low-lying areas, with high water table shallow pits are to be taken for planting and as the plant grows raise the basin to cover the developing bole.

Spacing: The spacing given will depend on the planting system, soil type etc. The following spacing is generally recommended (Table 17.1). Under normal conditions of good management, a spacing of 7.5 m × 7.5 m which will give a population of 170 plants per hectare, is recommended.

Table 17.1: Spacing Recommended for Coconut and the Plant Population

Planting System	Spacing	Approx. No. of Plants/ha.
Triangular	7.5 m	198
Square	7.5 m × 7.5 m	170
Single hedge	5 m in the rows and 9 m between rows	220
Double hedge	5 × 5 m in rows. 9 m between pairs of rows	280

Time of planting: Seedlings are to be removed by lifting with spade and the roots are removed. These are to be kept in shade and are to be planted as early as possible after removal from nursery. The best planting time of a place will depend on the rainfall pattern. If there is assured supply of water for irrigation, coconut can be planted at any time of the year. For parts of Kerala where there are two monsoons, the best time of planting for upland situations, is by the onset of south west monsoon, ie. May-June. However, for low-lying areas where water stagnation may be a problem, planting may best be done by September, i.e., after heavy rains. It is necessary to provide some shade for young seedlings after planting during the first year.

17.6 SHADING, WEEDING AND DROUGHT MANAGEMENT

Being a perennial tree, Coconut plantations are subject to infestation by different types of weeds which compete with the crops for water, nutrients etc. A major extent of the Coconut plantations survive under rainfed conditions where there is continuous dry spells up to 6 months a year. New coconut plantings require water and shade also for their proper establishment.

17.6.1 Shading

Coconut requires full sunlight for good growth and yield. However, it would need some shading during the first 2-3 years after planting till it fully establishes itself. Providing shade becomes relevant especially when the crop cannot be irrigated adequately. Shading is provided to the newly planted seedlings to protect them from hot sun during summer months. Shading with palm leaves around the plant is the usual practice. Necessary support should be provided to keep the leaves in position. Growing banana closer to the young Coconut seedling provided some amount of shade as the banana plants grow up. This provides additional income as well.

17.6.2 Weeding

Coconut when fully grown, allows more than 50 per cent of the sunlight to pass through its canopy and as such, the coconut field favours growth of a wide range of weeds when it is not intercropped. The traditional practice of weed control consists of digging or ploughing or forming mounds twice a year the first after the receipt of south-west monsoon in May-June and again towards the cessation of north-east monsoon by September-October. These operations though avoid

competition of weeds for water during the summer period and nutrients, will aid soil erosion and death of microbial fauna. Also these operations are expensive. As an alternative method, weeds may be slashed and the organic matter used as mulch. This will improve soil fertility, soil porosity and microbial growth.

17.6.3 Drought management

Moisture stress leads to stunted growth, drooping of leaves, immature nut fall and decreased yield. In irrigated coconut gardens, the following practices may be useful in combating drought:

Burying of coconut husk around the palm is a desirable practice particularly for moisture conservation. Husk can be buried either in linear trenches taken 3 m away from the base between rows of palms or in circular trenches taken around the palm at a distance of 2 m from the base. The trenches may be 0.5 m wide and deep. Husk is to be placed in layers with the concave surface up and covered with soil. The beneficial effect of coconut burial lasts for three to seven years. Moisture conservation in the early years of planting may be achieved by the burial of two layers of husk in the planting pits. This may then be covered with surface soil prior to planting.

Some of the other methods of drought management are:

- Mulching the basins with green/dry leaves including coconut leaves at the close of north-east monsoon (Oct-Nov). Mulches also will add organic matter to the soil on decomposition.
- On level field, excess water of rainy season may be conserved by taking small trenches in the field.
- On sloppy areas, the land may be terraced and trenches dug across the slope.

? Check Your Progress 2

Note: a) Use the space below for writing your answers.

b) Compare your answers with those given at the end of this unit.

1) Give the age of coconut seedlings suitable for planting.

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2) When is coconut seeds collected for sowing?

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3) What is the generally recommended spacing for coconut?

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17.7 NUTRIENT MANAGEMENT

Like any other plantation crop, coconut also requires adequate nourishment in the form of major elements as NPK and a number of minor elements available around, for normal growth and production. However, fertility status of the different coconut soils vary with respect to these nutrients lack of which leads to low yields. Therefore, proper understanding of the role of different nutrient elements is very necessary.

- ***Elements commonly deficient in coconut soils***

The nutrient elements showing deficiency in coconut soils are nitrogen (N) phosphorus (P), potassium (K), magnesium (Mg) and boron (B). The important functions of these elements on coconut and the dominant deficiency symptoms are given below.

— **Nitrogen:** This nutrient enhances growth of plants, leaf production, bunch production and nut and copra yields. The most apparent symptom of nitrogen deficiency is the paling of the green colour of leaves. Yellowing starts from the lower leaves and will proceed up. Abortion of female flowers (buttons), stunting in growth, reduction in the number and size of leaves and decrease in yield are the other symptoms.

— **Phosphorus:** It is required for root growth and in combination with other elements, enhances growth and yield. There are no clear visual symptoms of phosphorus deficiency other than stunting and decrease in yield.

— **Potassium:** This element induces early flowing, increases nut size, nut yield and higher recovery of copra. Deficiency symptoms include yellowing of older leaves, necrosis (drying) starting from leaf lip, stunted growth, reduced crown size, low yields and smallness of nuts.

— **Magnesium:** Deficiency of magnesium also leads to yellowing of leaves.

— **Boron:** The deficiency of this micronutrient though required in very small quantities, is frequently reported. Deficiency symptoms appear primarily on the leaf spindle which turns necrotic and blunt. New leaves become smaller with scorched margins. Symptoms of boron deficiency often are very similar to severe attack by mealy bugs.

- ***Correction of nutrient deficiencies***

Nutrient deficiencies are to be corrected by a combination of organic manuring and fertilizer application. Green manuring, green leaf manuring and cover cropping are also practices that will add nutrients.

The commonly used organic manures are farmyard manure, compost, sheep manure, poultry manure, fish meal, bone meal, green manures and green leaf manures. These organic manures contain all the essential nutrients required for the growth of plants but at lower concentrations. These nutrients also occur as part of the organic matter which are to undergo decomposition in soil before nutrients become available. Release of nutrients from these though slow, continues for longer periods. Organic materials unlike fertilizers, also improve the physical and biological conditions of soil. A certain minimum quantity of organic manures is therefore, essential and the quantity recommended to be applied is about 10 kg per pit in the initial three years and 25 kg thereafter.

The quantity of nutrients required for coconut is much higher than the quantity available from the organic manures at the above rates and hence, are to be supplemented with fertilizers. The fertilizer recommendation for different soils, varieties and other management situations are given in Table 17.2.

Table 17.2: Fertilizer Recommendation for Coconut in Kerala

		Quantity (Kg/palm/year)		
		N	P_2O_5	K_2O
1.	General recommendation			
	(a) Average management	0.34	0.17	0.68
	(b) Good management	0.50	0.32	1.20
2.	For reclaimed clayey soils (as in Kuttanad)	0.25	0.35	0.90
3.	Red loam soils (southern Kerala)	0.68	0.23	0.90
4.	Hybrids and high-yielding palms			
	a. For irrigated areas	1.00	0.50	2.00
	b. For rainfed conditions	0.50	0.32	1.20

The table gives the quantities of nutrients and the required quantities of fertilizers are to be calculated based on the nutrient content of the respective fertilizers.

For example, with fertilizers like urea (45 per cent N), super phosphate (16 per cent P_2O_5) and muriate of potash (60 per cent K_2O), the quantities of fertilizers required for good management (0.5:0.32:1.2) will be:

$0.5 \times 100/45$ = 1.1 kg urea

$0.32 \times 100/16$ = 2 kg super phosphate

$1.2 \times 100/60$ = 2 kg muriate of potash

Fertilizer recommendations for Coconut vary for different coconut growing states and these are based on soil and climatic conditions preventing in the particular area/region. Hence, a general recommendation relevant to each State is not available.

- ***Time of application of manures and fertilizers***

Organic manures may be applied along with fertilizers by the onset of south-west monsoon. Fertilisers may best be applied in two split doses for rainfed coconut,

one third in May-June and two-third by September-October. For irrigated crop, the entire quantity required for a year may be given in four equal splits in May-June, September-October, December and February.

- ***Method of application of manures and fertilisers***

For best root-nutrient contact, fertilisers and manures are to be applied in the active root zone (zone of concentration of roots) which in the case of adult coconut palm, extends to 2 m around the stem. Basins are therefore, to be of radius 1.8 m and may have a depth of 25 cm towards the periphery. Apply fertilisers in the basin in May-June and rake in. Manures are applied in the basin and covered with a thin layer of soil. Close the basin after application of the second dose of fertilisers in September - October for rainfed crop. For irrigated coconut where fertilisers are applied in four splits, the basins may be closed through applications of soil in smaller quantities after every fertiliser application.

- ***Green manuring and green leaf manuring***

When crops raised as manures are grown *in situ* and incorporated, it is called green manuring and when such materials are brought from outside, it is referred to as green leaf manuring. Green manure crops suitable for coconut are cow pea, crotalaria, sunhemp and Daincha and cover crops such as *Mimosa invisa*, *Stylo*, etc. While any plant can serve as a source of green leaf manures, a leguminous tree commonly grown for the purpose is Glyricidia. Growing green manure crops and incorporating the biomass is an inexpensive method of raising organic manure required for the field. It is a good practice for coconut plantations with reasonable light infiltration in the interspaces and where intercropping is not practiced.

Incorporation of all crop residues including residues of all intercrops and also coconut into the coconut basin is a good practice of maintaining the organic matter content of soil.

- ***Fertiliser application for young coconut***

The quantity of fertilisers recommended for coconut during the first year is one-third of the dose for adult palms and for the second year two-third. Full recommended adult dose is to be given from third year onwards. The splitting may be the same as for the adult palm.

- ***Integrated Nutrient Management (INM)***

Integrated nutrient management means the supply of essential nutrients through several sources, the components being fertilizers, organic materials and bio-fertilizers. In the case of coconut, the first two are more important and the advantages of using bio-fertilizers are under study. However, scope exists for the use of non-symbiotic nitrogen fixing organisms such as Azospirillum, Azetobactor etc., without altering the doses of organic manures and fertilizers.

Biomass produced by coconut which is to the tune of about 14 tonnes / ha / year and that from intercrops which is about 11 tonnes/ha constitute important organic supplements. The quality of these organic materials can be improved by vermi-composting.

- ***Liming materials and magnesium***

For the acidic soils, application of liming materials like hydrated lime, calcium carbonate and dolomite will be useful. The rate of application is 1kg per palm and

when done, it is to be applied in coconut basins at least 15 days before the fertiliser application of May-June. Dolomite contains magnesium also and when calcic liming materials are used, magnesium may be supplemented in the form of magnesium sulphate. The rate of application is 0.5 kg and the time of supply is September-October.

Activity 1: Visit a nearby Government seed farm/Research Station and observe the various practices followed for Coconut with special reference to cultural and nutrient management.

17.8 WATER MANAGEMENT

The quantity of water that is lost from a cropped field will depend on the nature of crop and climate. The four climatic parameters that directly affect the loss of water are temperature, sunshine, humidity and wind. Considering the average conditions of these four climatic parameters, estimates of water loss from the field can be made. The quantity of water to be used for irrigation will depend on the capacity of soil to hold water in the available form and the depth of penetration and spread of roots. The frequency of irrigation will depend on both the above factors, the rate at which water is lost and the water holding capacity of soil. Such a recommendation on irrigation scheduling worked out for coconut for two sets of climatic situations of Kerala and for four dominant types of soil are given in Table 17.3.

Table 17.3 : Irrigation Schedule for Coconut for Kerala

Parameters	Soil Texture			
	Sandy	Sandy Loam	Loam	Silty Clay
Available moisture (cm/m)	8	12	17	21
Quantity of water/irrigation/palm in litres in a basin of 1.8m radius	600	800	1300	1600
Frequency of Irrigation (days)				
All areas in Kerala except north-eastern portion of Trichur and Palghat districts	3-4	5	7-8	9
North-eastern portion of Trichur and Palghat districts	2-3	3-4	5-6	6-7

For different soils and different climatic situations, it is possible to arrive at irrigation schedules from data on water holding capacity of soils and the drying power of the atmosphere as measured through evaporation from a free water surface.

For a better water use, efficiency drip irrigation is now being widely used. Four drips per palm will supply 32 litres of water per hour and irrigating daily for two hours gives a steady supply of water to palm.

17.9 INTER AND MIXED CROPPING

By definition, both intercropping and mixed cropping refer to cultivation of more than one crop together. However, there is a difference between the two, that is; in inter cropping there will be a definite row arrangement whereas in mixed cropping, there will not be any such row arrangement. In the case of plantation crops like coconut, intercropping refers to the cultivation of short duration crops along with coconut. Examples are banana, pineapple, etc. When long duration crops like cocoa, nutmeg, clove etc., are grown along with coconut, it is mixed cropping. While taking up inter and mixed cropping, the following factors must be considered and managed.

1) Light infiltration through coconut canopy is highly variable and in a grown up plantation beyond the age of 20 years, it may range from as low as 30 to as much as 80 per cent depending on factors like age/height, canopy density and spacing. In the early years, light availability may range from close to 100 per cent soon after planting to about 20 per cent about 9 to 10 years after planting.

2) When light infiltration is less than about 30 per cent, it may be difficult to grow any crop in the interspaces successfully.

3) In the early years, almost any annual crop can be raised depending on availability of light.

4) Long duration crops can be considered only after about 20 years.

5) When the light infiltration is less than about 50 per cent, shade-loving and shade-tolerant crops may be chosen for planting.

6) Inter and mixed crops of coconut may be broadly grouped as shade-loving, shade-tolerant, shade-intolerant and shade-sensitive. Shade-loving crops are those whose yields will be higher under some level of shade than in the open. Ginger, turmeric and cocoa are examples. In the case of shade-tolerant crops, yields will be the best in the open and the yield will decrease with increasing shade. Examples of this category are colocacia, banana, clove and nutmeg. Shade-intolerant crops are those whose yield levels will be almost in proportion to the level of illumination. Most of the cereals, legumes, tuber crops like sweet potato, tapioca, vegetables like amaranthus, brinjal etc., fall into this category.

Another aspect to be considered while taking up intercropping is to avoid competition by intercrops with coconut for water and nutrients when grown together. Such a competition will not only adversely affect the intercrop but also the main crop, coconut. To avoid this, the alternatives are either to go in for short duration intercrops that can be sown and harvested during the rainy season or to provide irrigation during the dry period. It would mean that when mixed cropping is done, irrigation is a must lest the yield of coconut will be affected unless there is well distributed rainfall. Similarly, competition for nutrients will set in if these become limiting. The recommendations to tide over this are (1) to leave the active root zone of coconut (2 m round the base of the palm) for coconut roots alone and (ii) to provide adequate manures and fertilisers to all the crops separately. In order to avoid root overlapping, short duration crops may be planted leaving the basin

area of 2 m radius. When planting perennial crops, the root zone of associated crop also should be considered. For example, the active root zone of cocoa has about 1.5 m radius and as such the minimum distance to be provided between cocoa and coconut should be 3.5 m.

17.10 YIELD OF NUTS

Tall varieties of Coconut comes to bearing after about the fifth year under good management and reaches steady bearing by eighth year. Under exceptional management and with hybrids, first bearing may be advanced to third year and steady bearing may be expected from fifth year. Poor management may delay first bearing to eighth year and steady bearing to 15th year.

A coconut tree produces a bunch every month and harvesting is to be done at intervals of about one and half to two months, there being six to eight harvests in a year. Under good management, the average yield will be about 60 to 80 nuts per palm under unirrigated conditions and about 100 to 120 with irrigation. Under exceptionally good management conditions adopting mixed cropping systems, the yield of coconut increases considerably and steady annual yields of about 150 nuts per palm have been achieved over large areas.

? Check Your Progress 3

Note: a) Use the space below for writing your answers.

b) Compare your answers with those given at the end of this unit.

1) Which are the five nutrient elements whose deficiencies are common in coconut soils?

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2) What is the general fertilizer recommendation for coconut under good management?

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3) Give the extent of active lateral spread of coconut roots.

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4) Distinguish between the terms green manuring and green leaf manuring.

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5) What are shade-loving and shade tolerant crops?

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17.11 LET US SUM UP

Coconut, *Cocos nucifera* belonging to the family Arecacae is a crop of humid tropics. It can come up in a wide range of soils having about 2.0 m depth. Since coconut shows a high degree of variability, selection of mother palms to collect seed nuts is essential for production of quality planting materials. The selected nuts are to be sown in the nursery and maintained in the nursery for a year prior to planting. Field planting is to be taken up with the onset of monsoon. Planting depth and size of pit vary with soil type and water table. The field population is decided by the method of planting, square planting with a spacing of 7.5 m × 7.5 m being popular.

We have also discussed in this unit:

- Of the different nutrient elements needed for the growth of the coconut palm; N, P, K, Mg and Ca are the more important elements.
- Nutrient deficiencies are to be corrected using a combination of organic manures and fertilisers.
- Young coconut palms need to be irrigated with 45 litre of water once in two days in the dry period and are to be shaded. Irrigation schedule for established tree will depend on the water holding capacity of soil and the climate.
- This crop has to be harvested once in 1½ to two months and under good management, yield of above 100 nuts per palm per year can be expected.

17.12 GLOSSARY

Deficiency Symptoms : Symptoms produced by a plant following acute shortage of a given nutrient. Deficiencies of some nutrients like nitrogen are characteristic and can be used to diagnose deficiency.

Hybrids : Progenies produced by artificially crossing a given type of tall palm with another identified dwarf type and (or) two different desirable tall parents.

Intercropping : It denotes cultivation of short duration crops in the interspaces of coconut e.g. ginger, turmeric, banana.

Irrigation Schedule : It denotes the quantity of water to be applied at a time and the frequency at which it has to be done.

Mixed Cropping : It is the cultivation of long duration crops in the interspaces of coconut e.g. cocoa, nutmeg, clove.

Pre-potent Palms : High yielding trees whose progeny will inherit the high-yielding potential better.

Seeding Selection Criteria : Seedling characters which are strongly related to yield like early germination, number of leaves, collar girth early splitting of leaves etc.

CHECK YOUR PROGRESS: POSSIBLE ANSWERS

Check Your Progress 1

1) Kerala, Tamil Nadu, Karnataka and Andhra Pradesh.

2) 2.0 m

3) *Cocos nucifera L.* Family Arecaceae

4) Lakshaganga, Ananthaganga, Keraganga, Chandrasankara, Kerasree,

Check Your Progress 2

1) 10-12 months.

2) December-January to March-April.

3) 7.5 m × 7.5 m.

Check Your Progress 3

1) Nitrogen, phosphorus, potassium, magnesium and calcium.

2) 0.5 N, 0.32 P_2O_5 and 1.2 K_2O/palm/year.

3) 2 m round the bole.

4) When crops raised for use as manures are grown *in situ* and incorporated, it is called green manuring and when such materials are brought from outside, it is green leaf manuring.

5) Shade-loving crops will have a higher yield at certain level of shade than in the open. Shade-tolerant crops are those that yield their best in the open but will produce a reasonable yield under shade.

SUGGESTED READINGS

1) Anonymous (2002) *Package of Practices Recommendation: Crops.* Kerala Agricultural University, Vellanikkara.

2) Thampan, P.K. (1975). *The Coconut Palm and Its Products,* Green Villa Publishing House, Cochin-16.

3) Wahid, P.A, Salam, M.A. and Nair, R.R. (1993) *A Farmers' Primer on Coconut Cultivation.* Kerala Agricultural University, Vellanikkara.