KNOW ABOUT COCONUT ROOTS

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The health and vigour of a plant are conditioned mainly by the distribution and activity of roots. Because of the difficulties involved in studying roots, much less is known about their growth behaviour than has been learned about shoot growth. The root system is of great physiological importance for it is the moisture and salt absorbing region of most green plants and at the same time acts as an anchorage of the plant. In a perennial crop like coconut—being one of the most important economic species of palms—which yields throughout the year, a general knowledge of the root distribution, the location where maximum active roots occur and suitable zone for fertilizer application is of paramount importance.

Nature of the Root System

The coconut palm which is a monocot possesses an adventitious root system producing numerous fairly uniform roots having 8 to 10 mm diameter from the base of the stem called the bole. These roots are known as the main roots and they start from all sides of the bole. The number of main roots vary from tree to tree and also from tract to tract. An adult coconut palm normally possesses 4,000 to 7,000 roots on the West Coast of India. It is reported that a palm at CPCRI, RS, Kayamkulam has produced as many as 11,360 main roots. The main roots spread horizontally as well as vertically. They may spread very close to the surface or may go deeper into soil where water-table is very low. The main roots give rise to several lateral branches, which subsequently branch and rebranch. These are the rootlets, which are popularly known as the feeding roots. These roots concentrate around the bole and help in the absorption of nutrients. Numerous small whitish pointed outgrowths developing from the main roots as well as rootlets are called respiratory roots. These facilitate efficient gaseous exchange in roots. Because of their perforated surface these roots enable the atmospheric air to reach the growing tips of roots immersed in water or marshy places deprived of adequate aeration.

Normally coconut palms do not produce roots above the bole region. But in cases when they become old or grow under partial water logged conditions produce roots above the normal root producing region at the base of the stem in order to protect itself. These are known as the aerial roots.

Growth Rate and Longivity

The production of the main roots continue almost till the death of the tree. Owing to age the older roots die away and are replaced by new ones. The rate of growth of individual roots slows down beyond the third or fourth metre of their length in the horizontally spreading roots. This is evidenced from the absence of longer lengths of white tender portions beyond this length.

In well drained sandy soils, the tall variety of coconut lives upto 80 years or more. The roots at the lowermost regions of the bole are expected to be as old as the tree itself. This shows that the roots live for a very long time, even more than 50 years under suitable conditions. While most of the main roots are capable of living for over 20 years, the rootlets are short lived, a majority of the thinner ones dying every year during the dry summer months.

Absorbing Region of the Root

The root tip shielded by the root cap is the actively growing region and behind this for a short distance is the absorbing region. There are no root hairs. The absorbing surface of a single main root will equal that of a large number of rootlets put together. In a young growing main root a minimum of 5 cm length of absorbing region is available. On an average, a single main root was observed to absorb and pump up about 2cc of water in 24 hrs. The cut end of a root has much greater power of sucking. It was observed that the cut end of fully mature functioning root absorbs as much as 400 ml of water per day.

Spread

The actual range and spread of the roots depend on the variety of the palm and on the nature and drainage of the soil. In a sandy soil the range is greater than in a heavy soil and the roots will not easily penetrate a compact stony sub-soil. The spread of roots in 1/4 sector of a 40 year old healthy palm growing in well drained sandy soil was studied in detail at Kayamkulam. It was observed that about 50% of the roots of this middle aged tree penetrate deeper than 3 metre into the soil and about 38% have gone into the permanent water-table i.e., 5 m to 5.5 m. The surface feeders were concentrated within the first 1.5 m layer of the soil.

Studies conducted at CPCRI, Kasaragod to determine the region where the maximum concentration of functioning roots occur, showed that over 82% of the roots of the palm in the regularly cultivated and manured plot was found in the 31 to 120 cm depth and only 8-7% of the roots went below 120 cm. Regarding the lateral spread of the roots 74% of the roots emerging from the bole did not extend beyond 2 metres. It is also reported that regular cultivation and manuring had induced root production and that the surface rooting of coconut had been considerably reduced by the regular cultural operations.

Factors Leading to Root Development

The manner in which root system develops depends both on its hereditary potentialities and on certain environmental factors. While the hereditary potentialities are important in the development of the root

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system, the environment is also equally important. Included in the environment are soil characteristics such as texture, structure, depth, the amount of available water, the kind and concentration of solutes, pH, aeration and competition with the roots of other plants. Factors affecting the top of the plant such as grazing, cutting, defoliation by disease or insects and shading will also affect root development through their effects upon processes carried on in the top. Although it is seldom practical to modify the aerial environment of a coconut, the root environment can be modified by cultivation, fertilization irrigation and drainage.

Besides the obvious forms of competition for water and minerals there is another phase of root interaction that often is important. Some instances of injurious effects of grass and weeds on tree growth are attributed to depletion of nitrates or of oxygen or to production of excessive amounts of Co_2 in the soil. One reason why tree seedlings do not thrive in the dense sod of the prairies is because decomposition of organic matter and respiration of the grass roots produce a concentration of Co_2 too high for satisfactory growth of tree roots.

Every one is familiar with the yellowing of leaves, reduction in growth and eventual death of coconut palms when the soil in which they grow is oversaturated with water. This occurs because of injury to or death of the root system. This injury or death is caused by lack of oxygen and possibly by accumulation of Co_2 rather than by the direct effects of water. Loose soil, good areation and sufficient moisture are the important factors which promote better root growth in coconut. Soil management designed to provide these conditions to the palms will ensure proper root development.

Fertilizer application in relaton to active root zone

In India fertilizers are generally placed in circular basins of radius 1.20 to 1.80 m round the palm. This practice is supported by the observation that large numbers of rootlets which absorb plant food are concentrated around the bole upto a distance of almost 1.20 to 1.80 m.

It is reported from Sri Lanka that the surface application of fertilizers in the entire area round the palm upto a distance of about 1.65 m from the bole is the most economical and efficient method of fertilizer placement. Placement of fertilizers in close proximity to the zone of highest root activity would help maximise fertilizer uptake by the plant. A knowledge of the distribution of active roots in the soil and the location of the region where the density of absorbing root surface is highest are therefore essential pre-requisites to the rational use of fertilizers.

Studies made in Sri Lanka using radio isotopic technique to determine the efficiency of fertilizer utilization by coconut palms showed that the efficiency is greater when placed 10 cm lower than on the surface. The efficiency of uptake of nutrients was greatest at a lateral distance of 50 cm and it decreased with increase in radial distance, it being negligible beyond 2 metres. This indicates that the root activity is many times more within a radius of 2 metre and a depth of 10 to 40 cm. The activity of the roots is directly proportional to the number of functioning roots in the location. These studies confirm the present finding that a large proportion of the roots are confined within a radius of 2 metre and depth of 90 cm.

Root system is important not only as absorbing organs, but also in preventing erosion. The roots of the coconut palm serve as good soil binder and help to reduce the evil effects of erosion. The root is not the slave of the shoot but an equal partner. Satisfactory growth and reproduction and even the very survival of plants depend on the two parts being in harmony with each other in the common interest of the plant as a whole.

Coconut leaves soaked in saline water prior to plaiting withstand the combined action of wind, rain and sun better than the unsoaked in sweet water.

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When coconut leaves grow old and shed, they leave behind rough pitted scars encircling the whole stem and by counting these scars, the age of the palm can be approximately determined, 12 *to* 14 *successive scars being estimated to correspond to a year of growth of the palm.*

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