How fastidious is coconut in its climatic requirement ?

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Coconut, a perennial tree crop of long life is influenced considerably in its productive features by the environmental variables such as light, temperature, humidity and rainfall. Weather factors are known to influence production under rainfed condition. Of all the weather factors rainfall has maximum influence on the seasonal variation in yield. The advantage of well distributed rainfall on coconut production over the seasonal rainfall has been well established. Early cessation of south west monsoon, failure of north east monsoon and prolonged droughts have been common in the recent past resulting in considerable crop losses. However, rainfall is not a limiting factor for coconut growth if subsoil moisture is adequate.

What are the climatic requirement of coconut palm for good growth ?

The palm thrives well under warm humid weather conditions with an estimated 120 sunshine hours per month. The ideal temperature is 27° C with a diurnal variation of 5°C to 10°C and the palm cannot survive where the temperature fluctuations are considerable. However occasional fluctuations in temperature if it is not associated with very low humidity and high radiation will not have any deleterious effect on the palms.

In India the crop flourishes in the coastal belt of West Coast and East Coast, the reason being ideal climate without much temperature fluctuations. The crop flourishes up to an altitude of 800 to 900 m above sea level and above this level it hardly comes to fruiting. Even the limits to altitude and latitude are determined by temperature.

The impact of meteorological parameters on the growth and development of the coconut palms has been well established. It has been observed that the productivity of palms is affected if the adverse climate occurs during the three critical stages of fruit development i.e., initiation of inflorescence primordium, ovary development and button size nuts. The nut production during these periods can be sustained by giving life saving irrigation during summer months.

How do these climatic variables affect the growth and productivity of coconut ?

Since coconut is mainly cultivated under rainfed or limited water availability conditions, it has to withstand both soil as well as atmospheric drought for five to six months starting from January to May. Inadequate available soil water and high pan evaporation rate coupled with high radiation, temperature and vapour pressure deficit during this period aggravate the drought situation. Palms combat such a situation by drooping and breaking of the leaves, poor spathe development and shedding of buttons. Based on the soil water deficit and evaporation rate an aridity index could be worked out by which the intensity of drought can be assessed. Based on this, the breaking and drying of the drooped leaves as well as shedding of buttons starts at an aridity index of 100 percent. The physiology of palms during summer months reveals that these morphological symptoms are the reflections of the changes in the internal water balance and cellular metabolism.

Extensive studies carried out at CPCRI, Kasaragod, based on physiological and biochemical characters revealed the mechanisms for combating the adverse impact of atmosphere and soil on coconut. The studies clearly indicated that there is a threshold level for soil water deficit and meteorological parameters above which the palms cannot withstand moisture stress in the field. Micrometeorological parameters at Kasaragod during summer months i.e; February to April show considerable fluctuations in the ambient temperature and relative humidity than radiation received during the same time. It has been observed that coconut palms show stress effect in terms of stomatal closure, by which the palms regulate the internal water balance at a temperature >35° C, radiation >265 wm^{-2} and vapour pressure deficit (VPD)> 2.6 Kpa. (i.e. RH <50%). It has been observed that the highly stressed palms during water deficit condition has the capacity to recover better when the stress is relieved.

How do these micrometeorological parameters influence the normal physiology of the palms ?

High leaf temperature >40°C coupled with high solar radiation and high VPD have deleterious effect on the cell membranes integrity. This is usually determined by the electro-conductivity measurement of electrolyte leakage. The higher

electrolyte leakage observed in some of the drought susceptible types during stress period supports the view. This will directly affect the cell growth, metabolic functions, dry matter production and yield. In addition to this, high ambient temperature coupled with high light intensity inhibits the normal photosynthetic functions leading to reduced water use efficiency resulting in low yields.

How does the high temperature disrupt the cell membrane integrity ?

High temperature will denature some of the important enzymes which scavenge the toxic materials such as hydrogen peroxide and oxygen radicals produced during the incomplete oxidation of the metabolite inside the cells. These are toxic to the cell wall which lead to the higher peroxidation of cell wall lipids leading to cell membrane damage. In a drought tolerant palm the enzymes are activated more leading to the scavenging of all these toxic substances produced during the high temperature stress thus reducing the peroxidation of cell wall lipids. This helps in maintaining the membrane integrity and survival of the palms during atmospheric drought. Loss of cell membrane integrity will affect the production potential of the palms due to the impaired photosynthetic system.

Research conducted at CPCRI, Kasaragod revealed that some of the released coconut hybrids *viz*; Laksha Ganga (LO X GB), Chandralakha (LO x COD) and Kerasankara (WCT x COD) which showed relative tolerance to drought, also exhibited higher membrane integrity during summer months. These hybrids, expressed higher enzyme activities, reducing the peroxidation of cell wall lipids thus protecting the cell membrane and photosynthetic systems. The high cell membrane integrity in turn maintains the higher water balance leading to higher water use efficiency. The higher yield stability observed in the above hybrids during severe drought situation can be attributed to this.

From the foregoing it is clear that extreme weather conditions will disrupt the normal metabolism of the palms which in turn will affect the production potential. Hence, suitable varieties should be selected for cultivation in areas where fluctuation in atmospheric parameters are considerable.

CLEAN BILL OF HEALTH TO COCONUT, PALM KERNEL OILS

New research findings showing the beneficial effects of lauric acid on human health are likely to put coconut oil and palm kernel oil - in which lauric acid is contained in large measure - in a more competitive position.

Lauric acid, the major fatty acid both in coconut oil and palm kernel oil, has long been recognised for the unique properties that it lends to non-food uses in the soaps and cosmetics industry. More recently, it has been recognised for its unique properties in food use, which are related to its antiviral, antibacterial and anti-protozoal functions.

Now, capric acid, another of coconut's and palm kernel's fatty acid has been added to the list of the two oil antimicrobial components, according to Mr. Eric N. Enig, Executive Director of the US-based Centre for Research on Lauric Oils. Inc.

It is well-known that as the major source of crucial physiologically functional components in human diets, coconut and palm kernel oils play a unique role. Now, further evidence of their functionality is available.

According to Mr. Enig. newly published research has shown that lauric oils in the diet perform more than one function. They improve the immune system's anti-inflammatory response. In addition, they protect against alcohol damage to the liver; and lastly, normalise body lipids.

Now, both the oils could be recognised for another kind of functionality - the improvement of health of the ultimate end-user, the consumer, Mr. Enig said. Approximately 50 per cent of the fatty acids in coconut oil are lauric acid, while palm kernel contains about 48 per cent.

Lauric acid is a medium chain fatty acid which has the additional beneficial function of being formed into monolaurin in mammals. Monolaurin is the antibacterial, antivirus and anti-protozoal monoglyceride utilised to destroy lipid coated viruses such as HIV, herpes, cytomegalovirus, influenza, and various pathogenic bacteria.

Capric acid, accounting for some six to seven per cent of the fatty acids in coconut and palm kernel oils, is also a medium chain fatty acid and forms monocaprin in the body. Interestingly, monocaprin had also been shown to have antivirus effects against HIV and was currently being examined for anti-viral effects against some sexually transmitted diseases, Mr. Enig said.

Recently, the US Food and Drug Administration announced that it would begin requiring labelling of trans fatty acids (generally found in hydrogenated oils). This will put coconut oil and palm kernel oil in a more competitive position and may help return to their use by the baking and snack food industry where they have continued to be recognised for their functionality.

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