MINIMIZING DROUGHT DAMAGE ON COCONUT IN MAJOR SOIL TYPES

L P Vidana Arachchi
Coconut Research Institute of Sri Lanka

Prolonged drought conditions bring about moisture stress to coconut palm causing button nut fall and immature nut fall resulting in about 60% loss of potential coconut production. The damage due to drought in coconut could be minimized with the application of proper management practices. Effective and efficient moisture conservation practices or irrigation techniques could be developed only through scientifically sound basis. Therefore better knowledge of the soil physical characters, coconut root system, and moisture in the root-soil interface are essential to formulate proper management practices.

Water retention in different soils

Table 1 shows the ability and the duration of water retention in major coconut soils of the coconut triangle during dry periods. Results indicated that various soil types have different capacities to retain rain water during the hydrological cycle for example, the highest water retention was observed in the Melsiripura and Ambakele soil series. The result revealed that these soil types have the capability to retain more water for a longer period in the root zone of coconut. High water retention was also indicated in soil series of Madampe, Pallama, Katunayake, Welipalassa, Borupan, Gambura, Mavillu and Wilpattu. Coconut palms in these soil series were not severely affected by the drought. However Boralu, Andigama, Sudu, Kalpitiya and Kuliyapitiya series have a low potential to retain rain water, for a short period (about 2 weeks). Although water availability of Kalpitiya series is fairly low, the occurrence of a pure water lense at 1-2 m from the surface in Kalpitiya area would compensate for less moisture retention in soil. In addition, sandy soils (eg. Sudu series, Kalpitiya) allow infiltration of water at a high rate leading to leaching of fertilizer beyond the coconut root zone. In contrast, compact soils tend to waste more rain water through surface runoff due to poor infiltration. Therefore, appropriate moisture and fertilizer conservation measures have to be adopted to improve water holding capacity of both sandy and compacted clay loam soils. Such practices would minimize drought damage on coconut production to a greater extent.

Coconut root system

Effective root zone

Root growth and proliferation of the coconut palm vary with the physical charateristies. Generally, coconut roots spread throughout the soil profile and experiments have shown that about 75% of the coconut root zone occurs within the depth of 20 to 80 cm vertically and about 5% of root mass is found beyond 100 cm depth. Nuetron probe studies have revealed that, on moderately deep sandy clay loam soils, only the moisture stored at the depth of 20-80 cm range is extractable by the palm. But in deep loamy soils, moisture stored up to 150 cm depth is extractable. The water extraction is at maximum about 1 m distance from the bole of the palm.

In addition, absoption of water from

deeper layers by 5% of the root mass in deep loamy soils would be sufficient to a greater extent to meet the water requirements of the coconut palm, during dry periods.

As immature roots are more active in absorption of water and nutrient than lignified mature roots, they need to be protected from drought damage. Therefore, proper moisture availability should be ensured in the root-zone for efficient nutrient and water uptake and their survival.

Absoption zone of coconut roots

Coconut roots in contrast to other crops do not produce root hairs that absorb water and nutrients. The absoption zone of the coconut roots is the cream coloured region located just behind the root cap through which water and nutrients are taken up by the palm.

During dry periods, immature absoption zone is badly damaged by heat, water and soil physical stress. Cells of absorption zone of coconut roots in Andigama series (gravelly soil : suitability class 4) are severely damaged due to soil physical and water stress compared to Madampe series (sandy loamy soil; Class 1). Moreover, drought stress induces coconut roots to re-produce more roots, but these roots become inactive very soon.

Therefore, the drop in coconut yield due to drought could be (1) inefficient fertilizer absorption (2) thickening of coconut roots and (3) dehydration of immature roots.

Precautions

Studies on root characteristics under stress conditions have revealed the importance of soil moisture and conservation practices recommended by Coconut Research Institute. These practices are mulching, cover crop establishment, soil amelioration using organic manure, and husk/coir dust pits. Such practices help to conserve rain water in the soil. Irrigation techniques such as drip or basin irrigation linked with moisture conservation practices can be successfully adopted in severe dry periods to remedy the drought damage of coconut.

Studies carried out on soil moisture status have shown that soil series of Andigama, Sudu, Kuliyapitiya, Maho and Boralu need irrigation along with moisture conservation practices to remedy drought damage of coconut during severe dry periods. In contrust, soils with high water retention capacity, moisture conservation practices only would be sufficient to minimize drought damage. Moisture conservation practices could also improve physical properties of soil.Especially the usage of husk and coir dust pits improve coconut root penetration in hardy soils such as gravels. This would further improve the aeration and nutritional status of such soils.

THEY SAY..............

"I believe that coconut oil would become the new health oil in the next millenium." Monolaurin is among the world's "most kept secrets."

----- Dr. Jon J. Kabara, Emeritus
Professor, Michgan State University

Source: PCRDF News cope, Volume Number 1, First Quarter 1998

Table 1 Major soil series in the coconut triangle, their extent, moisture retention capacity and duration.

Agro ecological regions	Duration of dry periods (days) 1st	2nd	Soil series	Acerage in the coconut triangle (Ac)	Water retention capacity (mm)	Duration of water retention (days)
DL 3			Borupan	13,200	285	53
			Gambura	8,700	260	48
	75	135	Wilpattu	9,840	256	47
(Dry Low			Mavillu	10,260	238	44
country			Weliketiya	8,160	103	19
region)			Kalpitiya	8,240	53	10
IL 1			Kurunegal	157,840	92.8	19
(Semi-wet			Kuliyapitiy	58,480	56	11
Intermediate	75	75	Rathupasa	3,800	211.3	43
Low			Madampe	12,960	186.3	38
country			Sudu	1,400	42	9
region)						
IL 3						
(Semi-dry			Maho	37,120	105.8	22
Intermediate	75	120	Wariyapola	102,160	110.7	23
Low			Andigama	71,660	66	14
country			Ambakele	5,320	299.6	61
regions)			Welipelessa	12,960	199.1	41
IM 3 (Semi-dry Intermediate Mid country region)	60	135	Melsiripur-a	117,600	307.5	63
WL 3 (Moderatel-y Wet Low country	75	30	Boralu	59,600	55	12
region)			Pallama	49,120	193.4	40
WL 4 (Moderately Wet Low country region)	75	30	Katunayake	5,340	166.3	35