



ROOT DISTRIBUTION PATTERN OF PALMYRAH (*Borassus flabellifer* L.) IN RED SANDY SOILS OF EAST GODAVARI DISTRICT OF ANDHRAPRADESH

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ABSTRACT

The rooting pattern in palmyrah varies with the age of the palm. No studies were carried out to know the root distribution pattern in palmyrah under any kind of soil conditions. Therefore this study was undertaken to know the rooting pattern of different aged palms. In five year old trees the roots were spread to a distance up to 120 cm from the bole and to a depth of 90 cm from the surface. All the roots were found at a depth of 30-90cm and no root growth was observed at the top 30 cm portion. In ten year old trees the roots were spread to a distance up to 180 cm from the bole and to a depth of 120 cm from the surface. Almost 80% of roots were confined to a distance of 30 cm from the bole. Over 60 % of the root growth was found between 30-60 cm depth near the bole. The roots of 20 year old trees were spread to a distance up to 150 cm from the bole. 62.4 % of roots were observed up to the 60 cm distance, 35 % roots were found between 60 to 90 cm distance and only 10 % roots have spread beyond 90 cm distance from the bole. 80% of roots are confined to a depth range of 30 to 90 cm from the soil surface adjacent to the bole. 11 to 14% of roots were observed at a depth between 90 to 150 cm and most of them observed from 30 to 90cm distance from the bole. Less than 10% roots were found on the top 30 cm depth from the soil surface which could spread only to a distance of 30 cm.

Key words : Palmyrah, root distribution, red sandy soils.

Palmyrah palm is an important multipurpose tree of great utility. Due to its multifarious uses, palmyrah is equated to the “Kalpavriksha” in the mythology. Palmyrah is a total palm as each and every part of the plant is being utilized for one or the other purpose. It is referred as tree of life with nearly 800 uses including food, beverage, fibre, fodder, medicinal and timber. Among the various edible uses of the palm, the sweet sap tapped from the inflorescence for making palm sugar and palm jaggery is of prime importance. Ponnuswami and Kavino (2006) reported that palm juice known as neera is tapped from male and female inflorescence of the palm. Sap exuding from the cut inflorescence (spathe) is collected and commercially exploited in many Asian countries. The endosperm of the young fruit, like tender coconut, is a delicacy in summer. Palmyrah has an adventitious root system similar to the monocot. Adequate quantity of root biomass is essential for better uptake of nutrients and water and also for anchorage of roots of palmyrah palm. Palmyrah produces numerous number of roots throughout its life on the tap root and no branches are produced. The rooting pattern in palmyrah varies with the age of the palm. No studies were carried out to know the root distribution pattern in palmyrah under any kind of soil conditions. From the agronomic point of view it is necessary to study the root distribution of any crop for the efficient management of inputs supplied, therefore this study was undertaken to know the rooting pattern of different aged palms.

MATERIALS AND METHODS

Studies were conducted at Horticultural Research Station, Dr.Y.S.R Horticultural University, Pandirimamidi under AICRP on Palms during September to November, 2014 to

know the growth behaviour and distribution of roots in different growth stages of palmyrah palms viz; juvenile(5 year old), pre bearing(10 year old), young(15 year old) and adult stage(20 year old) palms. On farm trees of different age groups were used for the study. The soil in the experimental plot was composed of 88 per cent of sand, 10 per cent of silt and 2 per cent of clay. Five trees per each age group were used for the study. A trench was dug around the bole of the palmyrah tree to a distance of 3 m and to a depth of 1.5 m. For counting the number of roots present in different portions at different depths from top of the soil and away from the bole, The trench was divided in to eight zones at different radial distances from the bole i.e., 0-30cm (Zone A), 31-60cm (Zone B), 61-90 cm (Zone C), 91-120 cm (Zone D), 121-150 cm (Zone E), 151-180 cm (Zone F), 181-210 cm (Zone G) and 211-240 cm (Zone H) away from trunk. Each of these zones were again divided in to five depths of 0-30 cm, 31-60 cm and 61-90 cm 91-120 cm and 121-150 cm as such 45 trench zones i.e., A1, A2 and A3 under zone A, B1, B2 and B3 under zone B vice versa and the number of roots comes under each zone was counted in five age groups of trees and the data was recorded.

RESULTS AND DISCUSSION

The studies on the average root distribution in five year old trees revealed that the mean number of roots produced by a five year old palm was 29 (Table. 1). The roots were spread laterally to a distance up to 120 cm from the bole and to a depth of 90 cm from the surface. 62% of roots were confined to the 60 cm distance from the bole. All the roots were found at a depth of 30-90 cm and no root growth was observed at the top 30 cm portion.

Table-1 : Average root distribution in juvenile palmyrah trees (5 years age).

Distance from the bole / Depth from surface	0 - 30 cm		31-60 cm		61-90 cm		91-120cm		121-150 cm		151-180 cm		181-210 cm		211-240 cm		241-270 cm		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
0 - 30 cm	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31- 60 cm	21	72.4	7	24.1	3	10.3	—	—	—	—	—	—	—	—	—	—	—	—	—
61- 90 cm	8	27.5	11	37.9	5	17.2	2	6.8	—	—	—	—	—	—	—	—	—	—	—
91-120 cm	—	—	—	—	3	10.3	—	—	—	—	—	—	—	—	—	—	—	—	—
121-150 cm	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
151-180 cm	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	29	100	18	62	11	37.8	2	6.8	—	—	—	—	—	—	—	—	—	—	—

Table-2 : Average root distribution in pre-bearing palmyrah trees (10 years age).

Distance from the bole/ Depth from surface	0 - 30 cm		31-60 cm		61-90 cm		91-120 cm		121-150 cm		151-180 cm		181-210 cm		211-240 cm		241-270 cm		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
0-30 cm	48	26.3	11	6.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31-60 cm	111	60.9	18	9.8	9	4.9	4	2.1	2	1.09	—	—	—	—	—	—	—	—	—
61-90 cm	23	12.6	25	13.7	12	6.5	7	3.8	5	2.72	4	2.19	—	—	—	—	—	—	—
91-120 cm	—	—	—	—	6	3.2	—	—	—	—	—	—	—	—	—	—	—	—	—
121-150 cm	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
151-180 cm	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	182	100	54	20.6	27	10.30	11	4.19	7	2.6	—	—	—	—	—	—	—	—	—

The root studies in ten year old pre bearing palms revealed that the mean number of roots produced is 182 (Table-2). More than 87 per cent of the roots were found in the 0 – 60 cm depth. Top 30 cm depth has covered with 26.3 per cent roots and only 12.6 per cent roots were observed below 60 cm depth. Only 3.2 per cent of the roots were found below 90 cm depth and there was no root growth observed below 120 cm depth. Laterally almost 90 per cent of the roots were confined to 60 cm radius, however, out of this 79.4 per cent of roots were observed within 30 cm radius. Maheswarappa *et al.*, (2000) reported that in pre bearing coconut palm 62.7 per cent of the roots were found in 30 to 90 cm depth and laterally 92.1 per cent main roots were confined to 2 m radius. By radio-isotope technique, Anilkumar and Wahid (1988) reported that in coconut over 80 per cent of active roots were found to be confined at an area of 2m radius in 9 year old palm.

The average root distribution in fifteen year old young trees revealed that the mean number of roots produced is 886 (Table-3). The roots were spread to a depth up to 120 cm. Only around 10 per cent of the roots were observed in the top 30 cm depth. Almost 85 per cent of the roots were present in between 30 to 90 cm depth. No roots were found beyond 120 cm depth. The lateral root spread was observed up to a distance of 150 cm from the bole. 85 per cent of the lateral root spread is confined

to 90 cm radius and more the 68 per cent roots were observed within 60 cm radius. Carr, (2011) reported that in coconut the density of roots is greatest in the top 0 to 1.0 m soil, and laterally within 1.0 to 1.5 m of the trunk. In middle aged coconut palm Kushwaha *et al.*, (1973) reported that 73 per cent of the roots were found within 2m radius and most of them were confined to the 31 - 120 cm depth in red sandy loam soil.

In 20 year old adult palmyrah palms trees the mean number of roots produced is 1437 (Table. 4). Over 96 per cent of the roots were found in the top 0 to 120 cm depth. Top 0 to 30 cm depth had less than 10 per cent of roots and almost 85 per cent of the roots were confined to 31 to 90 cm depth. The roots were spread laterally to a distance up 150 cm from the bole. 62.4 % of roots were observed up to the 60 cm distance, 35 % roots were found between 60 to 90 cm distance and only 10 % roots have spread beyond 90 cm distance from the bole. Maheswarappa *et al.*, (2000) reported that in adult coconut palm over 95.5 per cent of the roots were found in the top 0 to 120 cm depth and 63 per cent of roots were confined to 31 to 90 cm depth. In middle aged coconut palm Kushwaha *et al.*, (1973) reported that 73 per cent of the roots were found within 2m radius and most of them were confined to the 31 to 120 cm depth in red sandy loam soil. Sen *et al.*, (1983) reported the 85.6 per cent of the 25 year old coconut roots were confined to 1.8 m radius in clay loam soil.

Table-3 : Average root distribution in young palmyrah trees (15 years age)

Distance from the bole / Depth from surface	0 - 30 cm		31-60 cm		61-90 cm		91-120 cm		121-150 cm		151-180 cm		181-210 cm		211-240 cm		241-270 cm		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
0 - 30 cm	92	10.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31 - 60 cm	446	50.3	188	21.2	73	8.2	12	1.35	—	—	—	—	—	—	—	—	—	—	—
61 - 90 cm	302	34.0	289	32.6	164	18.5	28	3.16	12	1.35	—	—	—	—	—	—	—	—	—
91 -120 cm	46	5.2	131	14.7	94	10.6	10	1.12	7	0.79	—	—	—	—	—	—	—	—	—
121 -150 cm	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
151 -180 cm	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	886	100	608	68.5	331	37.3	50	5.6	19	2.14	—	—	—	—	—	—	—	—	—

Table-4 : Average root distribution in adult trees (20 years age).

Distance from the bole / Depth from surface	0 - 30 cm		31-60 cm		61-90 cm		91-120 cm		121-150 cm		151-180 cm		181-210 cm		211-240 cm		241-270 cm		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
0 - 30 cm	134	9.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31 - 60 cm	584	40.6	241	16.7	115	8.0	31	2.1	—	—	—	—	—	—	—	—	—	—	—
61 - 90 cm	551	38.4	409	28.4	244	16.9	46	3.2	22	1.53	—	—	—	—	—	—	—	—	—
91 - 120 cm	165	11.4	203	14.1	122	8.4	68	4.7	19	1.32	—	—	—	—	—	—	—	—	—
121 - 150 cm	—	—	46	3.2	29	2.0	—	—	—	—	—	—	—	—	—	—	—	—	—
151 - 180 cm	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	1437	100	899	62.4	510	35.3	145	10	41	2.85	—	—	—	—	—	—	—	—	—

**Fig.-1** : Rooting pattern of pre bearing (10 year old) palmyrah palm.**Fig.-2** : Rooting pattern of adult (20 year old) palmyrah palm.

The root distribution and the number of roots varied widely with increase in age of the palm. From this study it can be concluded that the effective root zone for efficient

management of agronomic inputs lies within the 1m radius in 5 year old and 10 year old pre bearing palmyrah palm and within 1.5 m radius in 15 year old young and 20 year old adult palmyrah palms in red sandy soils of Andhra Pradesh.

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