

Cultivar and Nutrient Levels Influence the Aerial Roots and Morphometric Traits in Arecanut Palm (*Areca catechu* L.)

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Aerial roots in perennial plants are less studied subject. Arecanut palm is a commercial crop of humid tropics. This report pertains to the variability in traits of stem, leaf and aerial roots in four areca cultivars receiving five levels of fertilizer doses. Of the four varieties studied, "Mohitnagar" has grown to very tall stature with very low aerial roots. "Sreemangala" variety has shown high degree of aerial roots. These roots in this variety are rich in moisture. Nutrient level affected the canopy height. Varietal difference and its interaction with nutrient levels are found significantly for traits like height upto which rooting is seen and number of nodes showing aerial roots. The results of the study have practical implications in enhancing the knowledge on aerial roots in palms.

Introduction

Plants producing aerial roots is a subject of study that gives different insights about wide range of stems with varying roles in plant functioning. However, there are comparatively little scientific information is generated on this important part of the plant. Aerial roots are reported in palms such as arecanut (Davis, 1961), coconut (Menon *et al.*, 1955) and oil palm (Gearty *et al.*, 1976). Arecanut palm (*Areca catechu* L.) is an important plant grown mainly for masticatory / chewing nut in tropics. Genetic improvement of areca palm is being attempted by assembling the gene pool of the species. Further selection and hybridization programs are also carried out to obtain improved cultivars with high yield and desirable traits. Such long breeding programs in India resulted in few varieties viz., Mangala (VTL-3) (Bavappa, 1977), Sumangala, Mohitnagar and Sreemangala (Ananda *et al.*, 2000). The crop is highly nutrient responsive and significant interaction exists between cultivar and fertilizer levels on yield of arecanut (Sujalia *et al.*, 1999). Aerial roots in arecanut arises due to various reasons such as water logging for long periods, prolonged adverse soil conditions, surface planting, high density of plants and constant high humidity and exposure to heavy winds (Davis, 1961).

Objective of this experiment initially is to evaluate the suitability of cultivars and its nutrient requirements at North Bengal Sub Himalayan Terai region of India. This location is characterized by rains year round and thereby high humidity. The location of trial being a sandy loam soil without water logging during heavy rains many palms in this specific trial showed aerial

roots. Thus, the present study focuses on the nature of aerial roots along with stem and leaf traits as affected by cultivars and fertilizer levels in the arecanut palm.

Materials and methods

The experiment consists of four cultivars as Mangala (V1), Sumangala (V2), Sreemangala (V3) and Mohitnagar (V4) and five fertilizer treatments. The experiment was laid out in strip plot design with four replications. The five fertilizer treatments consist of No fertilizer (F0), half of the recommended dose of fertilizer (F1) with 50, 20, 70 g NPK /palm), full dose of the recommended dose of fertilizer (F2) with 100, 40, 140 g NPK/palm, one and half dose of recommended fertilizer (F3) with 150, 60, 210 g NPK/palm and double dose of the recommended dose of fertilizer (F4) with 200, 80, 280 g NPK / palm. The arecanut plant was spaced at distance of 2.7 m x 2.7 m on square system of planting. A plot size of six palms was used in this trial.

The location of the experiment is CPCRI Research Centre, Mohitnagar, Jalpaiguri District West Bengal during 2000. The farm is located at 26°N latitude, 88°E longitude with a mean altitude of 91.3 m above sea level. It receives an annual rainfall of more than 4000 mm and the maximum rainfall occurs in between April (995 mm) and September (996.5mm). Temperatures at this location vary between 8°C and 37°C. This trial was planted during 1991. Irrigation was provided during dry season alone. Weeding was followed as per the recommended package of practices. A total of 15 traits on stem, leaf, canopy and aerial roots have been recorded during the present study in 2004. Three palms

Table 1 : Influence of cultivar difference and nutrient levels on morphometric traits of arecanut

Treatment	Plant Height (m)	Canopy height (m)	Height of stem upto which roots seen (cm)	No. nodes from which aerial roots initiated	No. nodes upto which aerial roots initiated	Fresh wt. of aerial roots (g)
V1F0	5.83	3.09	31.91	3.13	6.33	515.56
V1F1	7.32	3.18	34.03	4.19	6.19	635.00
V1F2	6.35	3.13	49.28	4.83	7.44	460.00
V1F3	6.65	3.25	42.78	4.17	6.67	614.44
V1F4	6.99	2.97	30.14	3.36	6.36	672.78
V2F0	5.22	3.05	45.66	6.78	9.89	672.22
V2F1	5.96	2.98	53.5	9.00	10.83	840.00
V2F2	5.58	2.97	44.89	5.39	7.44	741.11
V2F3	6.12	3.17	35.00	4.28	5.72	460.55
V2F4	6.58	3.10	40.47	5.19	7.14	678.89
V3F0	5.69	3.17	57.53	8.87	10.07	1111.10
V3F1	6.90	3.09	52.42	7.07	8.84	1025.00
V3F2	6.50	3.13	61.11	9.00	10.69	1307.80
V3F3	6.80	3.12	55.44	9.07	11.47	824.45
V3F4	7.35	3.19	46.15	7.79	8.57	940.00
V4F0	7.53	2.98	33.87	3.00	4.20	527.78
V4F1	8.41	3.31	38.58	4.03	6.64	613.33
V4F2	8.44	3.05	35.64	4.33	5.11	660.00
V4F3	8.42	3.30	36.33	3.36	5.51	667.78
V4F4	8.64	3.21	40.62	3.50	5.67	562.22
V1	6.63	3.05	37.63	3.94	6.60	579.56
V2	5.89	3.14	43.90	6.13	8.21	678.55
V3	6.65	3.17	54.53	8.36	9.93	1041.70
V4	8.29	3.12	37.01	3.64	5.43	606.22
F0	6.07	3.07	42.24	5.44	7.62	706.67
F1	7.15	3.14	44.63	6.07	8.13	778.33
F2	6.72	3.07	47.73	5.89	7.67	792.22
F3	7.00	3.21	42.39	5.22	7.34	641.81
F4	7.39	3.12	39.35	4.96	6.93	713.47
Variety (LSD)	0.54	NS	9.20	1.21	1.87	299.58
Fertilizer (LSD)	0.51	0.09	NS	NS	NS	NS
Interaction (LSD)	NS	NS	9.95	2.30	2.98	NS

were randomly chosen in each of the replication for recording of morphological characters. Aerial root was collected from one-fourth area of the trunk and converted to whole palm by multiplying by four. Statistical analysis of the data is carried by analysis of variance and F test of significance.

Results and discussion

Height of the palm is affected by both variety and nutrient level. Of the four varieties studied, "Mohitnagar" has grown to very tall stature (8.29 m). Interestingly this variety is poor in production of aerial roots. Mohitnagar is a successful areca variety in Southern part of India with early and high yield.

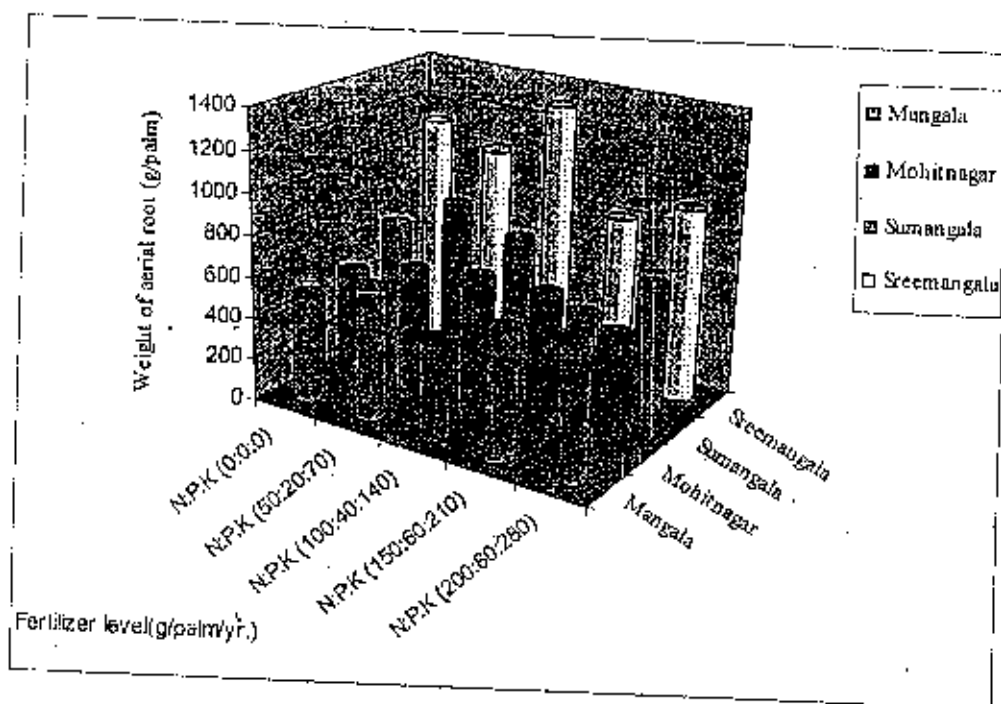


Fig. 1 : Aerial root of different arecanut variety at different fertilizer level

Farmers report this variety to have the quick growth and reaching of tall stature. F4 (Double of recommended fertilizer level) level of nutrient also promotes height of the areca plant.

Relationship exists between the plant size and aerial root production in other palms. Size of the palm determines the structure of stilt roots in arborescent palms rather than slope (Avalos *et al.*, 2005). Spread of canopy, stem girth (cm), number of pairs of aerial roots, dry weight of aerial roots (g), dimensions of aerial roots, leaf and leaf sheath (cm) are not significantly affected by variety or nutrient level or their interaction. Nutrient level alone affected the canopy height. Varietal difference and its interaction with nutrient levels are found significantly for traits like height upto which rooting is seen and number of nodes showing aerial roots. Sreemangala showed superiority over other varieties for these traits. This variety had a maximum of 9.93 nodes with roots (Table 1) and 8.36 nodes with roots initiation up to 54.53 cm height. Davis (1961) reported such aerial roots in height up to 2.5 m on the stem of areca palms located in high humid region of Konkan coast of Maharashtra in India. Sreemangala variety has also shown high degree of aerial roots with

highest fresh weight of 1041.7 (g/plant). Aerial roots in this variety are also rich in moisture content (data not shown).

Sujata *et al.* (1999) observed that cultivars of areca to vary in their nutrient requirements in realizing the yield potential. They found the Mangala variety to require double doses of NPK fertilizers than the needs of Sumangala and Sreemangala varieties.

Reddell *et al.* (1996) found the aerial roots in trees to assist in nutrient uptake and respiration of roots during periods of inundation. Role of aerial roots in improving the hydraulic architecture and water relations as seen in woody hemiepiphytes (Zotz *et al.*, 1997) needs verification by studying the water relations in areca palms. Latha and Palanisami (1996) found positive and significant effect of irrigation on economics of the crop. The present study shows that maximum numbers of aerial roots was occurred in variety Sreemangala. Other varieties also showed a certain degrees of aerial root formation. This may be due to the varietal characters or may be due to soil characteristics.

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