

Effect of Soil Mixtures on Germination and Growth of Arecanut Seedlings Under Sub-Himalayan Terai Region

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Abstract A study was conducted to assess the effect of soil mixtures on germination and growth of arecanut seedlings in primary and secondary nursery (poly bag) with different soil mixtures during 2003. Raised soil bed topped with vermicompost with arecanut leaf mulch gave maximum germination percentage (91%) of seednuts and vigorous seedlings (90%) than the other treatments. In case of secondary nursery, vigorous seedlings were obtained where FYM was a part of the soil mixture but maximum number of vigorous seedlings were obtained where soil mixtures of top soil and FYM (2:1) was used and the cost of seedling production was recorded as Rs 2.69 per seedling.

Keywords Arecanut, Primary nursery, Secondary nursery, Soil mixture, Vermicompost.

Introduction

Arecanut is a crop of warm humid climate. In India, it is mainly grown in southern states like, Karnataka,

Kerala, Tamilnadu. Besides, it is also grown in North Eastern states like Assam and Meghalaya and some other states like Maharashtra, Andhra Pradesh, Goa, West Bengal also shares a certain percentage of arecanut production. It is used for different purposes in India and abroad. Bhat [1] reported that it is propagated by seeds and seednuts should be sown just after harvesting of matured nuts in soil or sand beds. Different methods have been adopted to get better germination of arecanut as well as good quality seedlings at different places. Bavappa [2] reported that sprouting the seed nuts in straw gave lower germination (85%) and less establishment (76%) in the nursery as against 96% establishment in directly sown nursery. Different soil mixtures in primary and secondary nursery were used by different workers [3, 4] to get better germination and vigorous seedlings. Mostly, soil, sand and FYM and coir pith at different ratios were used as soil mixtures for arecanut nursery. The present investigation was carried out with different soil mixtures to see their effect on germination and growth performance of arecanut seedlings under primary and secondary nursery.

Materials and Methods

The seednuts of Mohitnagar cultivar were harvested during May, 2003 and sown in the nursery after harvest. Seednuts were sown in different conditions (Table 1). All the treatments were mulched with arecanut leaf. Raised soil bed was treated as control. The treatments were laid in a randomized block design with four replications. A total of 400 seednuts were used per treatment per replication. Observations

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Table 1. Treatments details. +. Arecanut leaf was mulched @ 5 leaves in 1 sq. m area, +. 15 kg FYM was used on top of the bed, # - 5 kg vermicompost was used on top of the bed, S- one inch thick sand layer was topped on bed.

Primary nursery Treatment details	Secondary nursery Treatment details	Ratio
T ₁ Raised sand bed + areca leaf mulch (ALM)*	T ₁ Top soil	
T ₂ Raised soil bed + ALM*	T ₂ Top soil + FYM	2:1
T ₃ Raised soil bed topped with sand [†] + ALM*	T ₃ Top soil + sand	1:1
T ₄ Raised soil bed topped with vermicompost [‡] + ALM*	T ₄ Top soil + FYM + sand	1:1:1
T ₅ Raised soil bed topped with FYM** + ALM*	T ₅ Top soil + coir pith + FYM	1:1:1
	T ₆ Top soil + areca husk + FYM	1:1:1
	T ₇ Top soil + sand + Vermicompost	1:1:1
	T ₈ Sand + FYM	1:1
	T ₉ Sand + vermicompost	1:1
	T ₁₀ Sand + coir pith + FYM	1:1:1
	T ₁₁ Sand + areca husk + FYM	1:1:1
	T ₁₂ Sand+coir pith + vermicompost	1:1:1
	T ₁₃ Sand+arecanut husk + vermicompost	1:1:1
	T ₁₄ Control (field)	

were recorded from randomly chosen 20 seedlings in each treatment and in each replication for all the characters except germination percentage. Observation

were recorded on germination percentage at different interval, number of leaf, plant height, leaf length and width, stem girth, number of root, root length, root volume, fresh and dry plant weight, fresh and dry root weight and per cent vigorous seedlings (discarding the deformed seedlings). After three and half months of sowing of seednuts, the seedlings were transferred in poly bags of 4 inch diameter and 8 inch height containing different soil mixtures (Table 1). Traditional seed bed method was treated as control. Each treatment consisted 200 seedlings with three replications. The experiment was set up in randomized block design. Observation on number of leaf, plant height, leaf length and width, stem girth, root number and length, root volume, root fresh and dry weight, plant fresh weight and dry weight were recorded from randomly chosen 20 seedlings in each treatment and each replication. Seedlings index was calculated with the formula

$$\text{Seedling Index} = \text{Number of leaf} \times 40 - \text{Plant height.}$$

The cost of seedling production was also calculated for all the treatments. Cost of materials for soil, sand, farm yard manure, cost of poly bags, coir pith, arecanut husk cost of labour for filling and planting, cost of seedlings at primary nursery, maintenance of seedlings, cost of plant protection measures, cost of damage due less germination and mortality (5%) at secondary nursery was considered for calculation of cost of seedling production. Average data were analyzed in both the cases.

Table 2. Germination profile of arecanut influenced by different seedbeds in primary nursery. Value in parentheses indicate the transformed value. *Significant at 5% level.

Treatments	Germination percentage							Percent healthy seedlings
	50 DAS	60 DAS	70 DAS	80 DAS	90 DAS	100 DAS	110 DAS	
T ₁	0.50 (4.05)	7.6 (16.0)	36.9 (37.4)	58.2 (55.73)	68.3 (55.73)	77.9 (61.96)	79.1 (62.80)	76 (60.87)
T ₂	0.38 (3.53)	7.3 (15.56)	31.9 (34.39)	52.0 (46.15)	66.8 (54.82)	80.6 (63.87)	84.1 (66.50)	83 (65.35)
T ₃	1.00 (5.74)	16.5 (23.97)	43.4 (41.21)	50.8 (45.46)	70.1 (56.85)	86.0 (68.03)	87.6 (69.38)	86 (68.28)
T ₄	0.88 (5.38)	18.9 (25.70)	33.4 (35.30)	55.3 (48.04)	76.9 (61.27)	89.3 (70.91)	91.0 (72.54)	90 (71.47)
T ₅	0.75 (4.97)	5.6 (23.26)	42.5 (40.69)	57.1 (49.08)	70.6 (57.17)	80.1 (63.51)	81.9 (64.82)	81 (63.79)
SE m ±	—	1.648	1.990	—	—	—	—	—
CD	NS	6.33*	7.64*	NS	NS	NS	7.78*	7.91*

Table 3. Growth parameters of areca seedlings influenced by different soil mixtures in primary nursery.

Treatments	No. leaf	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Stem girth (cm)	No. root	Root length (cm)	Root vol (ml)	Fresh plant weight (g)	Fresh root weight (g)	Plant dry weight (g)	Root dry weight (g)
T ₁	1.5	32.6	21.4	8.0	4.9	7.2	19.2	2.5	5.8	2.2	1.4	0.7
T ₂	1.4	35.8	20.2	8.6	5.2	8.3	16.4	2.5	6.8	2.1	1.7	0.6
T ₃	1.6	31.0	24.0	8.3	5.2	7.4	18.4	2.6	6.1	2.3	1.2	0.6
T ₄	1.6	35.7	20.2	8.3	5.4	8.5	16.0	2.3	5.6	2.2	1.3	0.6
T ₅	1.5	33.5	23.2	8.2	5.2	7.8	15.5	2.0	6.1	1.9	1.2	0.6
CD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Results and Discussion

The germination profile of arecanut seednuts in different treatments are shown in Table 2. Germination at 60, 70 and 110 DAS was differed significantly among treatments whereas, treatment differences were non significant in 50, 80, 90 and 100 DAS. The mean number of days required for commencement of germination was recorded as 50 DAS in all the treatments. Germination at 110 DAS varied significantly for all the treatments. Maximum germination percentage (91%) was recorded in T₂ where vermicompost was used. This was followed by T₃ (88%) and T₅ (84%). Production of healthy seedlings varied significantly for all the treatments. Healthy seedlings obtained

from all the treatments varied from 76-90%. Among the treatments, maximum numbers (90%) of healthy seedlings were obtained in T₁. This was followed by T₃ (86%) and T₂ (84%). Seedlings raised in primary nursery did not varied significantly for all the parameters recorded in all the treatments. However, among all the treatments, maximum leaf number per plant (1.60), stem girth (5.39 cm) and root number (8.45) were recorded in treatments where 5 kg/sq m vermicompost was topped with raised soil bed (Table 3). Bhatnagar and Palta [5] and Prabhu et al. [6] reported that vermicompost contains more plant nutrients, plant growth promoting substances such as hormones, vitamins and beneficial micro organisms which help in improving soil productivity. So the pres-

Table 4. Growth of areca seedlings influenced by different soil mixtures in secondary nursery. *Significant at 5% level.

Treatments	No. leaf	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Stem girth (cm)	No. root	Root length (cm)	Root vol (ml)	Fresh plant weight (g)	Fresh root weight (g)	Plant dry weight (g)	Root dry wt (g)	Seedling index
T ₁	4.3	41.3	33.3	11.0	6.2	11.5	26.0	2.2	26.9	5.3	5.1	2.0	125
T ₂	4.6	57.3	44.2	13.2	7.7	12.4	19.1	2.2	36.1	4.5	7.9	2.5	126
T ₃	3.8	37.5	31.9	10.1	6.0	13.3	25.6	2.7	22.4	6.3	4.7	2.0	123
T ₄	4.4	48.7	38.6	12.5	7.7	12.1	23.9	2.2	37.3	5.19	6.7	1.7	129
T ₅	4.3	45.6	35.1	11.1	6.6	11.3	19.9	1.9	32.5	4.2	6.7	2.1	127
T ₆	4.3	42.4	35.4	10.5	6.6	11.6	20.4	1.6	29.3	3.0	6.3	1.4	128
T ₇	4.3	42.4	35.5	11.2	6.6	12.1	19.0	1.6	28.0	2.4	5.3	1.1	128
T ₈	4.5	47.0	36.7	11.0	6.9	12.5	22.6	2.2	41.8	3.1	5.1	1.4	131
T ₉	4.2	42.4	33.8	11.5	6.6	12.3	17.2	2.4	33.5	4.6	7.7	2.0	127
T ₁₀	4.2	42.4	32.4	10.5	6.6	13.4	23.8	2.1	31.8	3.7	6.7	1.6	124
T ₁₁	4.2	42.4	33.1	10.2	6.4	12.1	20.2	2.4	30.3	3.8	6.4	1.8	124
T ₁₂	4.1	40.8	32.6	10.1	6.5	11.3	19.6	2.0	27.4	3.6	5.8	1.6	122
T ₁₃	4.2	42.9	32.8	11.3	6.5	19.0	19.0	2.4	32.8	5.8	4.8	3.0	123
T ₁₄	4.0	43.1	32.7	10.2	6.4	13.4	13.4	1.7	34.2	3.4	5.9	1.5	118
SEM ±	0.12	1.22	1.44	0.47	0.39	—	2.01	—	—	0.97	0.27	—	2.16
CD	0.26*	2.60*	3.06*	1.00*	0.83*	NS	4.279*	NS	NS	2.066*	0.565*	NS	4.61*

Table 5. Details of cost of cultivation of areca seedlings in different soil mixtures for 1,000 seedlings.

Sl. No.	Particulars	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	T ₁₂	T ₁₃	T ₁₄
1	Cost of Soil (Rs)	30	30	30	30	30	30	30	-	-	-	-	-	-	-
2	Cost of sand (Rs)	-	-	30	30	-	-	30	30	-	-	-	-	-	-
3	Cost of 100 kg FYM (Rs)	-	100	-	100	100	100	-	100	-	100	100	-	-	125
4	Cost of 60 kg vermicompost (Rs)	-	-	-	-	-	-	180	-	180	-	-	180	180	-
5	Cost of 50 kg Coir pith (Rs)	-	-	-	-	100	-	-	-	-	100	-	100	-	-
6	Cost of 60 kg Areca husk (Rs)	-	-	-	-	-	100	-	-	-	-	100	-	100	-
7	Cost of 1000 numbers polybags (Rs)	210	210	210	210	210	210	210	210	210	210	210	210	210	-
8	Cost of 1000 seednuts (Rs)	500	500	500	500	500	500	500	500	500	500	500	500	500	500
9	Charges for soil mixing and planting (Rs)	1000	1050	1050	1075	1075	1075	1075	1050	1050	1075	1075	1075	1075	-
10	Other charges including p. nursery, pp chemicals and maintenance (Rs)	650	650	650	650	650	650	650	650	650	650	650	650	650	650
11	Bed preparation & planting in control (Rs)	-	-	-	-	-	-	-	-	-	-	-	-	-	1300
12	Cost of seedling production (1000 nos) (Rs)	2390	2540	2470	2600	2670	2670	2680	2540	2620	2670	2670	2750	2750	2680
13	Cost of seedling production (each) (Rs)	2.39	2.54	2.47	2.60	2.67	2.67	2.68	2.54	2.62	2.67	2.67	2.75	2.75	2.68
14	Add loss due to germination (5%) and mortality at sec.nur (5%) (Rs)	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.15	0.16	0.16	0.16	0.16	0.16	0.16
15	Actual cost of each seedling production (Rs)	2.54	2.69	2.62	2.75	2.83	2.83	2.84	2.69	2.78	2.83	2.83	2.81	2.91	2.74
16	Production cost of 1,000 seedlings (Rs)	2540	2690	2620	2750	2830	2830	2840	2690	2780	2830	2830	2810	1910	2740

ence of some growth promoting substances in vermicompost improved the germination of areca seednuts and growth of the seedlings in T₄.

In case of secondary nursery, the impact of treatments varied significantly on all the characters except number of roots/plant, root volume, plant fresh weight and root dry weight (Table 4). Maximum number of leaf (4.6) was produced in T₂ and minimum number of leaves (3.8) was produced in T₇. In case of plant height, the maximum height (57.3 cm) was recorded in T₂ followed by T₄ (68.7 cm). Leaf length, leaf width and stem girth was the maximum in T₂ followed by T₄. The study revealed that where FYM is a part of the soil mixture, the vegetative growth is maximum than the other soil mixtures. It may be due to the ben-

eficial effect of FYM on seedlings growth. Maximum number of roots/seedlings was recorded in T₁₁ where a soil mixture of sand, arecanut husk and vermicompost was used in a ratio of 1:1:1. Maximum root length (26.0 cm) in T₁ followed by T₃ (25.6 cm), root fresh weight (6.3 g) in T₃ followed by T₁₃ (6.0g), root dry weight (3.0 g) in T₁₃ followed by T₂ (2.5 g), root volume (2.7 ml) in T₃ followed by T₆, T₁₁ and T₁₂ (2.4 ml) were recorded whereas plant fresh weight and dry weight was maximum in T₄ (41.8 g) followed by T₂ (36.1g) and T₂ (8.0 g) followed by T₇ (7.7 g), respectively. Seedling index was calculated in each treatment. Maximum seedling index value (131) was calculated in T₆ followed by T₁ (129), T₆ and T₁ (128) and T₄ and T₆ (127) but the treatments were statistically at par. Minimum seedling index value (118) was calcu-

lated in T_{14} (control). The study reveals that the plant characters like number of leaf, plant height, leaf length and width, plant girth which is responsible for getting of vigorous seedlings was the maximum where top soil or FYM was a part of the soil mixtures.

The cost of seedling production was also calculated for all the treatments (Table 5). The cost of seedling production ranged from Rs 2.52 (T_1) to Rs 2.91 (T_{13}). The cost of seedling production was more in treatments where coconut or arecanut husk or vermicompost was used as one of the ingredient. In case of T_2 the cost of seedling production was calculated as Rs 2.69 which was 15% lower than the control (T_{14}). Though the cost of seedling production in case of T_2 was more than some other treatments like T_3 and T_8 , but the percent healthy seedlings was more in T_2 .

From the study it is concluded that the raised soil bed topped with vermicompost is the best for raising of areca seedlings in primary nursery and soil

mixtures consisting top soil and FYM (2:1) was best for healthy seedlings production in secondary nursery in poly bags with 15% lower cost of production than control (T_{14}). The study also reveals that the performance of seedlings in poly bags was better than the seedlings grown in traditional seed bed method (field condition.)

References

1. Bhat KS (1956) The influence of drying on germination of seed arecanuts. *Mudras Agric J* 43 : 3—6.
2. Bavappa KVA (1956) Merits of different nursery practices in arecanut cultivation. *Arecanut J* 7 : 61—63.
3. Anonymous (1962) Annual progress report for 1961-62. Central Arecanut Res Station, Vitthal, India, pp 13.
4. Appaiah GN (1970) Improved arecanut nursery practices. *Lal Bahg* 15 : 5—8.
5. Bhatnagar RK, Palta RK (1996) Earthworm- vermiculture and vermicomposting. In : *Advantages of vermiculture*, pp 44. Kalyani Publ, New Delhi, India.
6. Prabhu SR, Subramanian P, Thambari C (199) Vermicompost from coconut leaves. *Exten Publ No.5* CPCRI, Kasaragod.