

EFFECT OF SEED SIZE AND SOWING ORIENTATION ON GERMINATION AND SEEDLING VIGOUR IN ARECANUT (*ARECA CATECHU L.*) VAR. METTUPALAYAM LOCAL

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The studies were conducted to find out the suitable seed size and sowing orientation for the production of vigorous seedlings in arecanut var. Mettupalayam Local in the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore. The results revealed that the germination (97 per cent), speed of germination (0.18), seedling growth (root and shoot length), stem girth (2.2 cm) and vigour index (3261) were maximum in larger size seeds (>31.6 g) when compared with smaller one. Among the orientations of sowing, vertical and horizontal orientations have registered maximum germination (96 per cent). Whereas, maximum seedling vigour and vigour index (3508) were registered in vertical orientation only.

Keywords : Arecanut; Seed size; Sowing orientation; Vigorous seedling.

Introduction

Arecanut (*Areca catechu* L.) is an important commercial plantation crop and India is the largest producer of arecanut, which accounts for 85 per cent of world's output. The states of Karnataka, Assam and Kerala account for almost 90 per cent of the area. The total area under arecanut cultivation in India is about 2.64 lakh hectares, producing 3.13 million tonnes of nuts annually. India exports arecanuts to UK, UAE, Canada, Maldives, Nepal, Singapore, Italy and South Africa and it exports 191.83 tonnes valued at Rs. 2.05 crores. India also exports 'scented supari' in which powdered arecanut is used as a principal ingredient. These products of 883.4 tonnes valued at Rs. 34.91 crores are exported to UAE, Saudi Arabia, Canada and UK. The hard dried endosperm of ripe and unripe seed called 'nut' is chewed as a narcotic and masticator. It may be chewed alone or as a constituent, along with leaves of *Piper betel*, slaked lime and chewing tobacco.

As arecanut has lot potential in our country economy, it is necessary to take much care for the increased productivity. The productivity can be improved by judicious selection of seedlings at the time of planting. Hence, production of good quality seedlings is of prime importance. It

is possible through the selection of optimum seed size for raising the seedlings. Also it is essential to sow the seeds in a right direction for the easy emergence of the seedlings. Hence, the studies were conducted to standardize the optimum seed size and sowing orientation for the production of vigorous seedlings.

Materials and Methods

The arecanut seeds were collected from the 45 years old plantation and the experiments were carried out in the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore during 1998-2001.

(i) *Size grading* : Freshly collected areca seed nuts were grouped based on size into six grades viz., G₁, G₂, G₃, G₄, G₅ and G₆. Then the physical parameters of the seeds such as weight, length, breadth, circumference and volume were measured for all the size grades. Among the physical parameters, the seed weight has been taken as the basic parameter for size grading and also the results were correlated based on the seed weight.

(ii) *Sowing orientation* : Freshly collected uniform size nuts were used for the experiment and the seeds were sown by adopting the following orientations.

- T₁ - Vertical (calyx end upward)
- T₂ - Slanting (calyx end at 45° angle)
- T₃ - Horizontal (calyx end sideward)
- T₄ - Inverted (calyx end downward)

In both the experiments, the germination test was conducted in sand medium with 50 seeds for each replication at 25± 2°C and 95 ± 2 per cent relative humidity¹. At the end of 90 days², the number of normal seedlings was counted and the germination per cent was calculated. During the germination test, the number of seeds germinated was counted from the day of first emergence and continued upto 90 days. Then the speed of germination was computed adopting the formula given by Maguire³. After the germination test, ten normal seedlings were selected at random and the shoot length, root length, stem girth, number of roots, seedling fresh weight and dry weight were measured. The vigour index was calculated using the formula, vigour index (VI) = germination per cent x mean length of seedlings (cm)⁴.

Results and Discussion

(i) *Effect of seed nut size* : In the present investigation, the larger size seeds (G₁) have registered the maximum values in all the physical characteristics (Table 1). Also the size grade G₁ (>31.6 g) were found to give significantly higher germination (97 per cent), speed of germination (0.18) and produced seedlings with higher vigour compared to other size grades (Table 1&2). Bavappa and Abraham⁵ found similar result in arecanut. It might be due to more food reserved in large size seeds which help in vigorous seedlings. Similar results were reported by many workers viz., Thampan⁶ in coconut and Chezhiyan *et al*⁷ in clove.

The seedling vigour parameters like shoot length (20.2 cm), root length (13.3 cm), stem girth (2.2 cm), dry weight (0.777 g) and vigour index (3261) were also maximum in larger size seeds (>31.6 g) when compared with smaller one (Table 2). Similar relationships between seed size and vigour have very well documented by many workers^{8,10}. The maximum reserved food

accumulation in the large size seeds would supply the nutrients continuously and that might be the reason for the increased seedling vigour.

(ii) *Effect of nut Orientation* : Recalcitrant seeds are characteristic of large size and hence orientation of sowing might expect to exert significant influence. Bagoury⁸ reported that sowing orientation is known to influence seed germination and seedling growth in large seed. Arecanut, a recalcitrant seed¹¹ has significant influencing effect due to sowing orientation. Here the experimental results showed that the seeds sown in vertical and horizontal orientations recorded maximum germination (96 per cent) followed by slanting orientation (94 per cent). While the inverted sowing orientation has performed very poor and it was registered 82 per cent germination (Table 3). In case of vertical sowing the presence of the embryo in the calyx end would facilitate the easy emergence of seedling towards upward direction. While inverted sowing, first the seedling has to emerge towards downward direction and then it has to emerge out from the soil with a bent. Therefore, it is difficult for their emergence and also it takes longer time to come out from the soil. Here the seed has to give more force for the emergence and even in some time it fails to emerge out.

Seedling vigour characteristics such as shoot length (21.6 cm), root length (14.9 cm), stem girth (2.3 cm), seedling dry weight (0.643 g) and vigour index (3508) were maximum in case of vertical orientation with calyx end upward when compared with other directions (Table 3). The earlier emergence and the direct supply of nutrients to the growing tip might be the reason for the increased seedling vigour. Similar results were also reported in coconut and the seeds should be planted in the nursery either vertically or horizontally^{6,12}. Here the vertical planting is preferable because of convenience in transporting, lesser risk of seedling injury^{9,12} observed that in cucurbitaceous vegetables emergence

Table 1. Effect of seed size grades on germination and seedling vigour in arecanut var. Mettupalayam Local.

Size grades	Weight (g)	Length (cm)	Breadth (cm)	Circumference (cm)	Volume (cc)	Germination (%)	Speed of Germination
G ₁	31.6	5.3	3.2	11.8	27.5	97 (85.39)	0.18
G ₂	22.3	4.4	3.0	10.8	21.3	97 (85.39)	0.16
G ₃	14.7	3.9	2.5	9.8	16.3	97 (85.39)	0.17
G ₄	12.2	3.6	2.2	8.3	12.5	96 (84.30)	0.14
G ₅	9.6	3.2	2.2	8.1	10.5	97 (85.39)	0.13
G ₆	6.5	2.7	1.9	7.0	6.5	94 (59.67)	0.09

SEd 1.13 0.11 0.05 0.13 1.99 6.25 0.02
 CD (P=5%) 2.38 0.25 0.12 0.28 4.12 13.14 0.04

(Values in parentheses indicate are sine values)

Table 2. Effect of seed size grades on seedling vigour in arecanut var. Mettupalayam Local.

Size grades	Shoot length (cm)	Root length (cm)	Stem girth (cm)	Number of roots	Seedling fresh weight (g seedling ⁻¹)	Seedling dry weight (g seedling ⁻¹)	Vigour index
G ₁	20.2	13.3	2.2	4.9	4.50	0.777	3261
G ₂	19.0	12.0	2.0	4.8	3.59	0.517	2602
G ₃	14.7	11.8	2.0	4.8	3.26	0.509	2483
G ₄	13.2	11.6	1.7	4.2	2.29	0.322	2404
G ₅	12.9	11.4	1.6	4.5	2.17	0.310	2224
G ₆	11.9	10.6	1.8	3.7	1.92	0.297	1765

SEd 1.32 0.57 0.10 0.28 0.28 0.068 169.9
 CD (P=5%) 2.78 1.21 0.21 0.59 0.59 0.143 357.0

Table 3. Effect of seed sowing orientation on germination and seedling vigour in arecanut var. Mettupalayam Local.

Treatments	Germination (%)	Speed of germination	Root length (cm)	Shoot length (cm)	Number of roots	Stem girth (cm)	Seedling dry weight (g seedling ⁻¹)	Vigour index
T ₁ Vertical	96 (82.62)	0.17	14.9	21.6	5.2	2.3	0.643	3508
T ₂ Slanting	94 (78.94)	0.17	13.9	19.6	4.9	2.2	0.591	3010
T ₃ Horizontal	96 (82.62)	0.16	13.0	18.4	5.0	2.3	0.592	3002
T ₄ Inverted	82 (65.35)	0.14	12.6	14.3	4.8	2.1	0.549	2204

SEd 5.64 0.01 0.49 1.72 NS 0.06 0.02 236.7
 CD (P=5%) 11.95 0.02 1.04 3.65 NS 0.14 0.04 501.9

(Values in parentheses indicate are sine values)

occurred early and percentage of emergence as well as seedling vigour were higher when the seeds were sown in vertical orientation with micropylar end upwards.

Acknowledgement

The first author thank the Indian Society for Plantation Crops (ISPC), Central Plantation Crops Research Institute (CPCRI), Kasaragod, Kerala for financial assistance to carry out this work.

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