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Effect of Seednut Size, Sowing Orientation and Nursery Area on Germination and Seedling Vigour in Coconut (*Cocos nucifera* L.) var. East Coast Tall

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Studies were conducted to find out the suitable seednut size, sowing orientation and nursery area for the production of vigourous seedlings in coconut (*Cocos nucifera* L.) var. East Coast Tall. The results showed that the growth rate and collar girth were higher in larger size seednuts (801-1200 g), when compared with smaller nuts (501-800 g). Seednuts sown vertically with calyx end pointed upward orientation have registered higher germination and seedling vigour. Among the nursery areas, beds raised in mist chamber condition showed higher growth rate (2.20) and plant height (82.6 cm). However, the collar girth (7.8 cm) and number of leaves (3.4) were more in the nursery beds raised under open condition.

Key words: Coconut, Seednut size, Sowing orientation, Nursery area, Seedling vigour.

Coconut (*Cocos nucifera* L.), is currently grown in 92 countries covering 11.9 million hectares of land in the tropical region. The countries like India, Indonesia, Brazil, Philippines and Sri Lanka share about 8 million hectares from which 78% of the world production is achieved (Laghar and Solangi, 2005).

Since, coconut has huge potential in indian economy, it is necessary to take much care to increase productivity. This can be achieved by judicious selection of seedlings at the time of planting. Hence, production of good quality seedlings is of prime importance which could be possible through the selection of optimum seednut size and right direction of sowing. Also, it is essential to raise the nursery in a correct place for the early emergence of the seedlings. Hence, studies were conducted to find out the optimum seednut size, sowing orientation and suitable nursery area for the production of vigourous seedlings.

Materials and Methods

The coconut seednuts in the variety East Coast Tall were collected from more than 40 years old plantation and the experiments were carried out in the Department of Seed Science and Technology, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai.

Seednut size

Freshly collected coconut seednuts were grouped into seven grades *viz.*, G_1 (201-600 g), G_2 (601-700 g), G_3 (701-800 g), G_4 (801-900 g), G_5 (901-1000 g), G_6 (1001 – 1100 g) and G_7 (1101-1200 g) based on the weight. Then the physical parameters of the seednuts 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.

The graded seednuts were dipped in carbendazim @ 0.2% for 5 min and sown in nursery beds filled with river sand. The experiment was conducted by completely randomized design with three replications and 200 seednuts in each replication. Then, the beds were irrigated regularly and seed bed was managed without weeds.

Sowing orientation

Freshly collected uniform size nuts were used for the experiment and the seeds were sown by adopting the following orientations.

T1 - Vertical orientation (calyx end upward)

T2 - Slanting orientation (calyx end at 45° angle

T3 - Horizontal orientation (calyx end sideward

T4 - Inverted orientation (calyx end downward)

The seednuts were dipped in fungicide and sown in the nursery beds in five replications with 200 seednuts in each replication by following the completely randomized design.

Nursery area

Freshly collected uniform medium size seednuts (901-1100 g) were used for the experiment and the seeds were sown in the nursery beds filled with river sand at different locations *viz*., N_1 - nursery bed in open condition, N_2 - nursery bed in shaded

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condition, N_3 - nursery bed in 50% shadenet condition and N_4 - nursery bed in mist chamber. The fungicide treated seednuts were sown in the nursery beds in five replications with 200 seednuts in each replication in a completely randomized design.

In all the experiments, number of seeds germinated was counted once in five days and growth rate was calculated by using the formula given by Maguire (1962). The germination per cent was calculated as per the ISTA (1999) procedure. After 150 days of sowing, ten normal seedlings were selected at random and plant height and collar girth were measured. The number of split leaves was also counted. The data collected were subjected to statistical analysis (Panse and Sukhatme, 1967) and the critical difference values were calculated at 5 % probability level.

Results and Discussion

Seednut size

In this experiment, the larger size seednuts (G_1) have registered the higher values in all the physical characteristics observed (Table 1). Among the different seednut size grades, G_5 (901-1000 g) and G_6 (1001-1100 g) have registered speedy germination (1.75) followed by G_7 (1.74), when compared to smaller nuts G_1 (501-600 g). The higher

Table 1. Seednut size grades and their physical traits in coconut var. East Coast Tall

Seednut size grades	Seednut Weight (g)	Length (cm)	Breadth (cm)	Circumference (cm)	Volume (cc)
G_1	501-600	19.3	8.5	29.9	533
G_2	601-700	22.6	12.1	37.4	579
G_3	701-800	23.1	13.4	39.4	605
G_4	801-900	23.3	14.0	41.1	638
G_5	901-1000	25.3	14.3	42.2	776
G_6	1001-1100	26.9	14.8	44.8	904
G7	1101-1200	27.8	18.4	54.0	994
		1.2	0.5	1.2	47.2
SEd		2.5	1.0	2.6	101.3
CD (P=0.05)					

collar girth was observed in G_5 (6.0 cm) followed by G_6 (5.8 cm). Similarly, the number of leaves was more in G_5 and G_6 (3.3) as compared to smaller seednuts (2.1) (Table 2).

However, there was no difference in germination and plant height among the different grades. Thampan (1981) found similar result in coconut and reported that nuts having lesser weight had germinated much later compared to heavy nuts and produced shorter seedlings with fewer roots and leaves. Similar results were reported by several workers *viz*., in coconut (Liyanage, 1982) and arecanut (Farooqi and Sreeramu, 1999; Raja *et. al*., 2003). The maximum reserved food accumulation in the large size seednuts would have supplied the nutrients continuously and that might have been the

Table 2. Effect of seednut size on germination and seedling vigour in coconut var. East Coast Tall

Seednut size grades	Growth rate	Germination (%)	Plant height (cm)	Collar girth (cm)	No. of split leaves
G_1	1.27	87	56.1	5.2	2.1
G_2	1.50	84	59.6	5.7	2.6
G_3	1.46	84	64.2	5.7	2.9
G_4	1.72	85	61.4	5.7	2.9
G_5	1.75	84	61.4	6.0	3.3
G_6	1.75	85	61.1	5.8	3.3
G7	1.74	85	61.8	5.7	3.1
SEd	0.04	2.9	2.4	0.1	0.2
CD (P=0.05)	0.09	NS	NS	0.2	0.4

reason for the increased seedling vigour. Nevertheless, Wickramaratne *et al*. (1987) suggested that the nuts should not be rejected on the basis of size, quantity of nut water or shape. Identification of nuts as empty (devoid of nut water) or immature therefore, unlikely to germinate. It is more advisable to dispense with seednut selection and lay all nuts harvested from the selected palms in the nursery. Final selection of seedlings in the nursery should be carried out subsequently, as usual.

Sowing orientation

Recalcitrant seeds are characteristic of large size and hence, orientation of sowing might be expected to exert a significant influence. Bagoury (1973) reported that sowing orientation is known to influence seed germination and seedling growth in large seed. Coconut, a large recalcitrant seed has significant influencing effect due to sowing orientation. Experimental results showed that the seednuts sown in vertical and horizontal orientations have recorded higher germination (90%) followed by slanting orientation (89%). While, inverted sowing, of seednuts recorded 70 per cent germination (Table 3). In case of vertical sowing the presence of the embryo in the upward calyx end would facilitate easy emergence of seedling towards upward direction. While in inverted sowing,

Table 3. Effect of seednut sowing orientation on germination and seedling vigour in coconut var. East Coast Tall

Sowing orientation	Growth rate	Germination (%)	Plant height (cm)	Collar girth (cm)	No. of split leaves
T_1- Vertical orientation	2.12	90	78.6	8.1	3.8
T_2- Slanting orientation	2.10	90	77.9	8.0	3.6
T_3- Horizontal orientation	2.00	89	73.1	8.0	3.6
T_4 Inverted orientation	1.43	70	52.5	6.3	2.0
SEd	0.10	3.1	5.2	0.5	0.5
CD (P=0.05)	0.20	6.5	11.1	1.0	1.1

the seedling has to emerge first towards downward direction and later emerge out from the soil with a bent. Therefore, the process of emergence would be difficult and consume longer time to come out from the soil. Also the seeds have to give more force

for the emergence, at times it may even fails to emerge out. Similar results of sowing orientation on seedling emergence were reported in coconut and arecanut palms (Thampan, 1981; Farooqi and Sreeramu, 1999; Raja *et al*., 2003).

Seedling vigour traits such as growth rate (2.12), plant height (78.6 cm), collar girth (8.1 cm) and number of leaves (2.0). The earlier emergence and the direct supply of nutrients to the growing tip might be the reason for the increased seedling vigour in the vertical orientation. Similar results were reported in coconut and the seeds would be planted in the nursery either vertically or horizontally (Thampan, 1981; Farooqi and Sreeramu, 1999). However, the vertical planting is preferable because of convenience in transporting, lesser risk of seedling injury (Farooqi and Sreeramu, 1999).

number of split leaves (3.8) were higher in case of vertical orientation with calyx end upward (Table 3). Similarly, the horizontal and slanting orientations have also showed on par performance with vertical orientation. However, inverted sowing of seednuts performed poor by and recorded the lowest growth rate (1.43), plant height (52.5 cm), collar girth (6.3 cm) and number of leaves (2.0). The earlier emergence and the direct supply of nutrients to the growing tip might be the reason for the increased seedling vigour in the vertical orientation. Similar results were reported in coconut and the seeds would be planted in the nursery either vertically or horizontally (Thampan, 1981; Farooqi and Sreeramu, 1999). However, the vertical planting is preferable because of convenience in transporting, lesser risk of seedling injury (Farooqi and Sreeramu, 1999).

Table 4. Effect of nursery area on germination and seedling vigour in coconut var. East Coast Tall

Nursery area	Growth rate	Germination (%)	Plant height (cm)	Collar girth (cm)	No. of split leaves
N_1 - Nursery bed in open condition	1.97	94	79.0	7.8	3.4
N_2 - Nursery bed in shaded condition	1.85	88	77.4	6.7	2.8
N_3 - Nursery bed in 50% shadenet condition	1.84	90	71.8	6.3	2.7
N_4 - Nursery bed in mist chamber condition	2.20	95	82.6	5.7	2.5
SEd	0.1	3.5	2.6	0.9	0.09
CD (P=0.05)	0.2	NS	5.5	1.8	0.2

Nursery area

The seednuts sown in different nursery areas showed significant differences in germination and seedling vigour. The growth rate of seedling was higher (2.20) in nursery beds raised in mist chamber (N_4) compared to other places. Also, the seedlings produced in this condition have recorded higher plant height (82.6 cm). The high and continuous humid climate in the mist chamber would have favoured the early emergence and taller plants. However, the collar girth (7.8 cm) and number of leaves (3.4) in the seedlings were more in the nursery beds under open condition (N_1) (Table 4). The good sunlight with adequate aeration in the open beds might be the reason for higher collar girth and number of leaves in such seedlings. It is evidenced that the quality of the seedlings was enhanced by adequate soil water and high level of solar radiation on the nursery beds (Peries and Everard, 1995). Peries (1984) suggested that the conventional nursery managed under optimum environmental conditions perhaps, with slicing of nuts as a refinement was capable of producing better results. Also the traits like collar girth and number of leaves are to be considered as important criteria while selecting the seedlings for planting.

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