J. Phytol. Res. **15** (2) : 183-186, 2002

EFFECT OF PRE-SOWING SEED TREATMENTS ON GERMINATION AND SEEDLING VIGOUR IN ARECANUT *(ARECA CATECHU L.)*

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Pre-sowing seed treatment in arecanut showed that the dehusked seeds recorded the higher germination (100%), speed of germination (0.20), seedling vigour and vigour index (3889) followed by soaking in 2, 4-Dinitrophenol at 10^{-3} M. Dehusked seeds also take minimum number of days to start germination (34 days) when compared with control (58 days) and other soaking treatments.

Keywords : Arecanut; Early germination; Pre-sowing seed treatment; Vigourous seedling.

Introduction

Arecanut (*Areca catechu L.),* also known as betelnut, is an important commercial plantation crop of India belongs to the family Arecaceae. India is the largest producer of arecanut, which accounts for 85% of world`s output. The other countries in which it is grown are Bangladesh and Sri Lanka. Arecanut is also cultivated in Malaysia, Indonesia, Philippines and some of the Pacific Islands in smaller area. The states of Karnataka, Assam and Kerala account for almost 90% 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[1].

The hard dried endosperm of ripe and unripe seed called `nut' is chewed as a narcotic and outrivals chewing gum in popularity on a world basis. It may be chewed alone or as a constituent, along with leaves of *Piper betel* slaked lime and chewing tabacco. Arecanut seed has the alkaloids like arecaine, arecoline, arecaidine, guvacoline, guvacine and chlonine and these compounds have pharmacological properties include actions on intestinal helminths and parasympathetic system[2].

Arecanut is propagated through seed and the seeds take longer time to germinate. Rapid as well as enhanced germination is essential for good plant performance and hence the present study was taken up to find out suitable pre-sowing seed treatment to increase and speed up the germination.

Materials and Methods

Areca seed nuts of uniform size were collected freshly in a 40 years old plantation and the following treatment were given in the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore during 1998 - 2001.

Treatments

T_0 - Control (unsoaked whole seed)
T_1 - GA3 250 ppm
T_2 - GA_3 500 ppm
T_3 - IAA 250 ppm
T_4 - IAA 500 ppm
T_5 - NAA 250 ppm
T_6 - NAA 500 ppm
T_7 - KNO3 1.0%
T_8 - KNO3 2.0%
T_9 - 2, 4-Dinitrophenol (DNP) 10^{-3} M
T_{10} - 2, 4-Dinitrophenol (DNP) 10^{-4} M
T_{11} - Water soaking
T_{12} - Dehusked Seed

The seed nuts were soaked in the above chemicals and water for 24 h at room

temperature. At the end, the excess solutions were drained off and thoroughly washed with water. Generally, in arecanut the whole fruit with husk is called as seed or seed nut. Therefore, the dehusked seed was obtained by removing the husks on the seed. Germination test was conducted in sand medium with 25 seeds for each replication at 25 ± 2° C and 95 ± 2% relative humidity[3]. At the end of 90 days[4], the number of normal seedlings were counted and the grmination percentage was calculated. After the germination test, ten normal seedlings were selected at random and the seedling vigour parameters were measured. The seedlings used for measurement were dried under shade and then kept in a hot air oven maintained at 85% ± 1° C for 24h. Then the seedlings were cooled in a desiccator for 30 min. and the dry weight of seedlings was taken. During the germination test, the number of seeds germinated was counted from the day of first emergence and continued up to 90 days. Then the speed of germination was computed[5]. The vigour index was calculated using the formula, Vigour Index (VI) = Germination percentage x mean length of 10 seedlings[6] (cm)[6].

The data collected were subjected to statistical analysis. Critical difference values were calculated at five percent probability level and non-significant values were indicated as `NS`. Wherever necessary, the percentage values were transformed into arc sine (angular) values and such transformed values were indicated in the respective tables in parentheses.

Results and Discussion

Highly significant difference was recorded for germination percentage due to germination improvement treatments. Maximum germination of 100% was recorded due to the seed soaking treatments particularly in GA_3 250 ppm, NAA 500 ppm, KNO_3 2.0% 2,4- Dinitrophenol at 10^{-3} M and 10^{-4} M, water soaking and also in dehusked seeds.

While in case of the speed of germination, highest value of 0.20 was recorded in dehusked seeds followed by soaking the seeds in 2, 4-Dinitrophenol at 10^{-3} M (0.19). Similarly, dehusked seed starts germination much earlier (34 days) when compared with sowing of whole seed nut (58 days) and other soaking treatments.

In case of seedling measurements, the dehusked seed produced the seedlings with longest shoot (24.4 cm) followed by the seeds soaked in 2, 4 - Dinitrophenol at 10^{-3} M solution (21.2 cm) when compared with control (12.7 cm) . Generally in arecanut the seedling vigour especially the stem girth at collar region is a good indicator for planting the seedlings in the main field. Therefore, seedlings with maximum stem girth are essential and it was recorded maximum in the seedlings grown from dehusked seeds and 2, 4- Dinitrophenol at 10^{-3} M soaked seeds (2.2 cm). Another vigour parameter such as root length was highly significant due to germination improvement treatments. Among the treatments, seedlings raised from the seeds soaked in 2, 4-Dinitrophenol at 10^{-3} M recorded the longest roots (15.1 cm) followed by dehusked seed (14.5 cm). Significant difference was also observed in seedling fresh weight, dry weight and vigour index values and they were maximum in seedlings from dehusked seeds when compared with control.

Generally arecanut seeds take longer time to germinate[8] and hence rapid as well as enhanced germination are essential for plant performance as it ensures, amongst other things a good plant start. Roberts[9] stated that the activity of phenol oxidase in the covering structures might lead to oxygen starvation of the embryo and that inhibition of phenol oxidase would make available more oxygen to the embryo. In the present study, the dehusked seeds recorded maximum germination (100%), speed of germination (0.20), seedling vigour and vigour index (3889) and minimum number of days to start germination (34) followed

Table 1. Effect of pre-sowing seed treatments on germination and seedling vigour in arecanut.

Treatments	Germination %	Speed of germination	Number of days to start germination	Shoot length (cm)	Stem girth (cm)	Root length (cm)	Number of roots	Seedling fresh weight (g Seedling^{-1})	Seedling dry weight (g Seedling^{-1})	Vigour index
T_0-Control (unsoaked whole seed)	91 (72.57	0.13	58	12.7	2.0	11.7	4.5	3.09	0.428	2199
T_1-GA_3 250 ppm	100 (90.00)	0.15	53	19.8	2.1	12.9	4.8	4.02	0.588	3273
T_2-GA_3 500 ppm	85 (67.50)	0.13	48	15.7	2.1	11.4	4.7	3.97	0.579	2303
T_3-IAA 250 ppm	85 (67.50)	0.12	48	16.2	2.0	10.9	4.8	3.83	0.585	1864
T_4-IAA 500 ppm	75 (60.11)	0.12	57	13.4	2.0	12.1	4.5	3.55	0.518	1909
T_5-NAA 250 ppm	85. (67.50)	0.13	57	14.2	1.9	13.7	4.8	3.10	0.454	2377
T_6-NAA 500 ppm	100 (90.00)	0.16	53	13.5	1.8	12.5	4.6	3.18	0.466	2377
T_7-KNO_3 1.0%	90 (71.56)	0.15	53	15.1	2.0	12.0	4.5	3.90	0.541	2438
T_8-KNO_3 2.0%	100 (90.00)	0.15	53	15.1	2.1	12.5	4.4	3.90	0.542	2754
T_9-2,4-Dinitrophenol 10^{-3}M	100 (90.00)	0.19	44	21.2	2.2	15.1	4.6	3.74	0.785	3622
T_{10}-2,4-Dinitrophenol 10^{-4}M	100 (90.00)	0.18	44	20.1	2.1	14.3	4.5	4.67	0.611	3436
T_{11}-Water soaking	100 (90.00)	0.16	45	17.4	2.1	10.6	4.4	4.43	0.649	2799
T_{12}-Dehusked seed	100 (90.00)	0.20	34	24.4	2.2	14.5	5.0	4.95	0.815	3889
SEd	3.07	0.009	0.85	1.83	0.08	0.76		0.48	0.07	165.2
CD (P=5%)	6.65	0.020	1.71	3.96	0.18	1.65	NS	1.05	0.15	357.0

(Values in parentheses indicate arc sine transformed values)

by seeds soaked in 2, 4 - Dinitrophenol at 10^{-3} M solution (Table 1). The enhanced rate of germination and seedling vigour in dehusked seeds might be due to the ease access of oxygen to the embryo, which enables the seeds to start to germinate earlier. Pollock and Kirsop[10] and Roberts[9] also reported similar results and it was due to the complete or partial removal of husk in arecanut[11]. Increased germination due to the removal of pulps in clove[12] and nutmeg[13] were also reported. Broschat[14] observed an earlier and vigourous germination due to the removal of the endocarp in *Butia capitata*. In the present study, seeds soaked in 2, 4 - Dinitrophenol at 10^{-3} M were also exhibited higher seedling vigour . The reason might be might be due to its action either as an uncoupler of oxidative phosphorylation at lower concentrations or as an inhibitor of terminal oxidases at higher concentrations as reported by Roberts and Smith[15] and Das[8].

Acknowledgement

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

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