INNOVARE JOURNAL OF AGRICULTURAL SCIENCE

INNOVARE ACADEMIC SCIENCES Knowledge to Innovation

Vol 10, Issue 5, 2022

ISSN - 2321-6832

Research Article

EFFECT OF SORTING AND SPACING ON THE GERMINATION OF COCONUT GROUND BED NURSERY

KOLOCHE MUSA IBRAHIM[1], ODUFALE OLADAPO OLANREWAJU[1]*, ADAIGBE VICTOR CHUKS[2], YAHAYA SADIQ ABDULRAHMAN[3], ADEYEMI-AJIBULU ABIMBOLA MUBO[1]

[1]NIFOR Coconut Substation Badagry. [2]Department for Research and Development in Coconut. Email: odufaleoladapo@gmail.com

Received: 18 August 2022, Revised and Accepted: 30 August 2022

ABSTRACT

Cultivation of coconut is deterred by unavailability of improved planting material. Reducing the quantity of un-germinated seed nuts will optimize nursery space as well as increase seedling production per cycle. The experimental design was randomized complete block with two treatments at two levels each and four replicates. Four hundred seed nuts were randomly selected while the remaining Four hundred were selected by sorting. The seed nuts were arranged in the seed beds in two treatment pattern "spaced" and "cluster" sowing methods with spacing of 30 cm by 30 cm and 5 cm by 5 cm, respectively. There was no significant difference between the spacing methods tested. As much as spacing is between 5 and 30 cm, the germination rate will be similar in ground bed nursery. There were differences in the germination parameters between the sorted and unsorted seed nuts. Sorting had significant effect on seed nut emergence 59.38A and 42.38B; $p<0.05$ for the unsorted and sorted, respectively. The number of days to emergence and germination was significant at 10% (84.50A; 72.72B), 25% (101.25A; 90.63B), and 50% (126.50A; 110.38B) for the unsorted and sorted respectively. The significant negative correlation coefficient (–0.56, $p<0.05$) between 50 and maximum germination (MGP) percentage indicated that sorted seed nuts attained 50% germination earlier than the unsorted ones. This will be effective in determining the duration of MGP percentage in the seed lots. Sorting before sowing is essential to ensure early germination of seed nuts and to achieve high germination percentage. It will as well save resources.

Keywords: Seed-nuts emergence germination correlation.

 DOI: http://dx.doi.org/10.22159/ijags.2022v10i5.46153. Journal homepage: https://innovareacademics.in/journals/index.php/ijags

INTRODUCTION

Coconut (*Cocos nucifera)* is an under cultivated crop in Nigeria with an estimate of about 15,000 hectares of land cultivated with coconut whereas, about 1.2 m hectares of land is identified as cultivable with coconut (Akpan, 2008, Osemwegie *et al.*, 2016). Coconut is highly sought after in Nigeria even though it is not readily available as a result of shortfall in production capacity. The solid endosperm is widely consumed as food crop, or processed into confectioneries, coconut flour, coconut oil which is consumed by household and also serves as raw material for industries.

In Nigeria, coconut is with many challenges, especially unavailability of improved seedlings and inadequate number of seedlings to meet the teeming demand of farmers for planting in many instances (Odufale *et al*., 2021). Coconut has been found to grow and do well in various soil types ranging from coastal soils, sandy soil, sandy loamy soils, among other soil types (Gunn *et al.,* 2011, Okpamen 2014, Osemwegie 2016). However, Jeff 1999 posited that soil type could affect the rate of germination and eventually the performance of coconut. He also emphasized that soils that are too compact, drain poorly and that dry out too quickly can slow or hinder germination.

Coconut is considered as recalcitrant and viviparous (live bearing) plant because the embryo has the ability to continue growing non-stop on the mother palm (Child 1974, Chin and Robert, 1980). The ripe fruits bunch, after falling to the ground may not germinate immediately and thus, it has to be cured before sowing. It however loses viability if dried in storage. The greatest cause of poor germination in coconut is dead seeds or non-viable seeds. On a general term, when palm seeds are well matured, it facilitates higher percentages of germination. Except in few exceptions, such as *Dypsis lutescens*, in which the maturity of the seed does not matter (Broschat and Donselman 1987). With most palms, propagation from seed is not difficult as long as a few basic requirements are met. Among the most important are freshness of the seed, good sanitation, proper hydration, and adequate heat (Jeff, 1999).

In certain circumstances, coconut can germinate to produce seedlings high above ground level while still on the mother palm (Harries, 2012). Matured fruit can be harvested from the palm at a specific stage of development (11^{th} or 12^{th} "month" or when the skin of the husk begins to change color). They may be stored before setting, or set without undue delay. Sometimes a thin slice of husk is removed or a cavity is made in the husk to receive nutrients and increase the absorption of water into the husk, or the husk may be partially or entirely removed for other purposes (Ugbah and Akpan, 2003).

METHODS

The study was conducted at the NIFOR Coconut Substation Badagry, Lagos State Nigeria. Randomize complete block design was adopted with two treatments and four replications with each of the treatment plot containing fifty coconut seed nuts. It was randomized complete block design with two treatments at two levels each and four replications. Each of the treatment plot contained fifty coconut seed nuts. The coconut fruit bunches deployed in this study were harvested when some of the fruits have started turning brown which is an indication of maturity of the bunch as adopted by Menon and Pandalai 1958, Harris 2012. Thereafter, the seed nuts were allowed to cure for 3 weeks before sowing. Before sowing, the seed nuts were partially sliced close to the point of attachment to the stalk according to the procedure of Ugba and Akpan 2003.

Treatments

1 The first treatment was sorting which had two levels, un- sorted and sorted. Four hundred out of the eight-hundred seed nuts used for this study were randomly selected blindly without any criteria while the remaining Four hundred were selected by sorting. The criteria for sorting were by:

i. Selecting seed nuts that showed signs of slushing
ii. Selection of seed nuts without deformity
iii. Selection of seed nuts that did not show signs of disease infestation.

2 Sowing pattern: The seed nuts were arranged in the seed beds in two treatment patterns "spaced sowing" and "cluster sowing" methods which were the two levels of treatments. In the spaced treatment, the seed nuts were arranged on the seed bed in a set of 10 rows by 5 columns with spacing of 30 cm by 30 cm along the columns and rows while in the cluster arrangement, the seed nuts were arranged closely with a spacing of 5 cm by 5 cm along the columns and rows.

Parameters evaluated

The following germination parameters were evaluated for each of the treatments and replicates. Seed nut Emergence (E): Was the number of days it took for the first crow beak to emerge which represented emergence in each set of the sown seed nuts in each of the experimental plots Germination interval (GI): Was the number of days between the first seed nut emergence and the last seed nut emergence in each of the treatment plot.

Ten percent germination (TP): Is the number of days it took for the first TP of the sown seed nuts to emerge in each of the treatment plot.

Twenty-five percentage germination (TFP): Is the number of days it took for the first twenty-five percent of the sown seed nuts to emerge in each set of the treatment plot.

Fifty percent germination (FP): Is the number of days it took for the first FT of the sown seed nuts to emerge in each set of the treatment plot.

Maximum Germination (MGP): This is the MGP percentage achieved by each of the treatment plot

Statistical analysis

Analysis of variance (ANOVA) as well as Pearson correlation was used to evaluate the germination parameters from the treatments. Duncan Multiple Range Test was deployed to separate the mean of the treatments tested at the two levels.

RESULTS AND DISCUSSION

ANOVA

The spacing did not affect germination and the emergence of coconut seed nuts (E), duration of germination (LG), GI, 25% germination (TFP), 50% germination (FP) as well as the number of days to achieve MGP. However, it affected number of days to achieve TP the sorting methods had significant effect on the rate of seed emergence ($p<0.05$) and the number of days to coconut seed nut emergence at 10% (TP), 25% (TFP), and 50% (FP) germination at $p<0.01$, respectively, while planting type was only significant with TP at $p<0.05$.

The GI as well as the number of days to achieve MGP were not affected by either of the sorting methods and planting types tested except TP which was significant at $p<0.05$ (Table 1). There was as well no significant interaction between the sorting method used and the methods of planting except at the 10% rate of germination and emergence.

The mean indicated that there was no significant difference between the two sorting methods evaluated in terms of the number of days to emergence (E) (No Sorting,59.38A; Sorting, 42.38A), LG (No Sorting, 154.50A; Sorting, 149.25A), GI (No Sorting, 95.13A; Sorting,106.88A) and MGP (No Sorting,66.25A; Sorting, 72.25A), respectively. There were, however, significant differences in the mean of TP (No Sorting,84.50A; Sorting, 72.72B), TFP (No Sorting,101.25A; Sorting, 90.63B) and FP (No Sorting,126.50A; Sorting, 110.38B) which were essential indices in the evaluation of germination and performances of the seed nuts (Table 2). On the other hand, there was no significant difference between the two spacing methods on the germination parameters (Table 3).

Correlation analysis

The number of days to emergence had significant positive correlation with only two of the germination parameters; GI and TP. Emergence had negative correlation with the GI (-0.936, $p\leq0.01$) but direct correlation with TP germination (0.647, $p\leq0.01$). Besides TP, number of days to emergence had no significant correlation with any other percentile measured germination parameter. The number of days to the last seedling germination (LG) had no linear relationship whatsoever with any of the other germination parameters evaluated. The number of days to achieve TP germination had positive significant relationship with both of TFP (0.59; $p\leq0.05$) and FP (0.50 $p\leq0.05$). However, the number of days to achieve MGP was not affected by any of the germination parameters except FP (-0.56; $p\leq0.05$) Table 4.

DISCUSSION

The rate of germination of seeds is very important in seed production and nursery management. This study indicated that there was no significant difference between the planting methods tested, that is, irrespective of the space between the seed nuts in as much as it is between 5 and 30 cm, the germination rate will be similar in ground bed nursery. Hence, clustering the seed nuts with space of 5 cm between them is good enough to save space and other resources. This finding is in line with that of Eufemia and Rebecco 1980 and Peries, 1984 which stated that germination rate and cost of raising coconut in the nursery was different at 25 × 25 cm from those planted with spacing of 40 × 40; 60 × 60 and 80 × 80 cm. There was significant difference in the germination parameters between the sorted and unsorted seed nuts. The number of days to emergence, TP, twenty-5%, and FP germination were earlier in sorted than the unsorted seed nuts. Sorting will save time and other resources employed in nursery management practices. During the process of sorting, seed nuts that are not likely to germinate and those that were not fit were removed from the seed lots. This must have been responsible for the differentials in the number of days to emergence, TP, TFP, and FP. The sorted seed nuts had higher germination percentage when compared with the unsorted seed nuts although the difference was flagged as not significant by the ANOVA.

According to Harris 1981; 2012, once few seed nuts begin to germinate, it stimulates other seed nuts to germinate as well especially if they are of same variety. This must have been responsible for the insignificance

Table 1: ANOVA mean squares of germination parameters of tall coconut variety and their response to sorting types and different methods of planting

Source	Df	E	GI	TP	TFP	FP	MGP
Rep	3	42.42	55.00^{NS}	6.75^{NS}	42.56^{NS}	136.56^{NS}	21.66^{NS}
Sort Type	1	1156.00^{*}	552.25^{NS}	552.25^{**}	451.56^{**}	1040.06^{**}	144.00^{NS}
Spacing Type	1	25.00^{NS}	25.00^{NS}	182.25^{*}	7.56^{NS}	0.56^{NS}	9.0^{NS}
Error	9	234.14	288.61	27.19	43.23	96.06	114.78
R^2		0.38	0.22	0.64	0.60	0.63	0.19
CV		30.08	15.99	8.30	6.85	8.27	15.47

ANOVA: Analysis of variance, E: Emergence, GI: Germination interval, TP: Ten percent germination, TFP: Twenty-five percentage germination, FP: Fifty percent germination, MGP: Maximum germination

Table 2: Means of germination parameters of tall coconut variety and their response to two sorting methods

	No sorting	Sorting
E	59.38A	42.38A
LG	154.50A	149.25A
GI	95.13A	106.88A
TP	84.50A	72.72B
TFP	101.25A	90.63B
FP	126.50A	110.38B
MGP	66.25A	72.25A

N.B: Means with the same letters are not significantly different at p≤0.05

Table 3: Means of germination parameters of Tall coconut variety and their response to two spacing methods

	Spacing at 30 cm	Spacing at 5 cm
E	52.13A	49.63A
LG	151.875A	151.88A
GI	99.75A	102.25A
TP	75.25A	82A
TFP	96.63A	95.25A
FP	118.63A	118.25
MGP	70.00A	68.50A

N.B: Means with the same letters are not significantly different at p≤0.05

Table 4: Correlation analysis of germination parameters of Tall coconut variety and their responses to two sorting and spacing methods

	E	GI	TP	TFP	FP	MGP
E	1.00	−0.94**	0.65**	0.40	0.31	−0.21
GI		1.00	−0.64**	−0.48	−0.30	0.18
TP			1.00	0.59*	0.50*	−0.31
TFP				1.00	0.77**	−0.31
FP					1.00	−0.56*
MGP						1.00

NB: *, **Indicated Significant at 0.05 and 0.01 level of probability respectively

difference in the GI observed. Number of daysto emergence and other germination parameters evaluation are important criteria used in discrimination among coconut genotypes as demonstrated by Fernando *et al.,* 1993; Zizumbo-Villarreal, 1998; Harris, 2012. The lack of significant difference in the GI might have been because only one population of tall variety was involved in the study. However, the study was able to show that the sorting will be appropriate in coconut nursery. FP germination will be effective in determining the MGP percentage in the seed nuts. The negative significant correlation coefficient between FP germination and MGP percentage indicated that when seed nuts were sorted, it attained FP germination earlier than the unsorted seed lots and thus had higher germination percentage than the unsorted seed lots.

CONCLUSION

Sorting of seed nuts before sowing is essential to ensure early germination of seed nuts and to achieve higher germination percentage. It will as well save time, cost, and other resources used in nursery management practices.

REFERENCES

Akpan EE. In House Review of Researches of the Nigerian Institute for Oil Palm Research, Report; 2008.

Broschat TK, Donselman H. Effect of fruit maturity, storage, presoaking and seed cleaning on germination in three species of plants. J Environ Hortic 1987;5:6-9.

Child R. Coconuts. 2nd ed. London, UK: Longman; 1974. p. 335.

Chin HF, Roberts EH. Recalcitrant Crop Seeds. Kuala Lumpur, Malaysia: Tropical Press; 1980. p. 152.

Eufemia AA, Rebecco MS. Response of coconut seedlings to spacing and application of nitrogen and potassium. Ann Trop Res 1980;2:89-95.

Fernando WM, Pieris TS, Wickramaratne MR. Variation in seedling characters of three different coconut cultivars and their use in identification in the nursery. Cocos 1993;9:23-9.

Gunn BF, Baudouin L, Olsen KM. Independent origins of cultivated coconut (*Cocos nucifera* L.) in the old world tropics. PLoS One 2011;6:e21143.

Harries HC. Germination and taxonomy of the coconut palm. Ann Bot 1981;48:873-83.

Harries, HC. Germination rate is the significant characteristic determining coconut palm diversity. AoB Plants 2012;2012:pls045.

Jeff M. A practical guide to germinating palm seeds. J Int Palm Soc 1999;???:56-9.

Menon KP, Pandalai KM. The Coconut Palm, A Monograph. Ernakulum: Indian Coconut Committee; 1958.

Odufale OO, Oluwaranti A, Odiowaya G, Ahanon MJ, Agho C, Okoye MN, *et al*. Characterization of coconut accessions from selected germplasm using morphological traits. Niger Agric J 2021;52:17-24.

Okpamen SU, Omoruyi E, Aondona O, Nkechika A, Ikyaahemba PT. Data documentary on soil nutrient and yield evaluation comparison for coconut varieties in four soils of coconut belts. Int Res J Agric Sci Soil Sci 2014;4:57-64.

Osemwegie QE, Anyiwe MA, Odewale JO. Econometric analysis of the economic cost of lethal yellowing disease (LYD) on coconut (*Cocos nucifera* L.) yield in LYD epidemic area of Nigeria: A case study of Nigerian institute for oil palm research (NIFOR). Am J Exp Agric 2016;11:1-10.

Peries RR. Some observations on the pre-nursery system for raising coconut seedlings. Cocos 1984;2:10-17.

Ugbah MM, Akpan EE. Effect of nut positioning and husk slashing of nut germination and growth of two coconut varieties. Niger J Palms Oil Seeds 2003;15:11-21.

Zizumbo-Villarreal D, Arellano-Morín J. Germination patterns in coconut populations (*Cocos nucifera* L.) in Mexico. Genet Resour Crop Evol 1998;45:465-73.