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EFFECT OF FRESH KOLA NUT SIZE [*COLA NITIDA* (VENT.) SCHOTT. AND ENDL.] ON GERMINATION AND EMERGENCE

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ABSTRACT

Selected fresh kola nuts from National Centre for Agronomic Research located in Divo, were used to study the effect of fresh kola nuts size on its germination and emergence. The experimental design was a Fisher block with five treatments and three repetitions. The treatments consisted of different kola nuts size, scarified and soaked in water during 48 hours. Thirty-five days after sowing, large kola nuts (40-50g) had the highest germination rate (100%) and emergence rate (79%) whereas the lowest percentages of germination rate (60%) and emergence rate (40%) were recorded for small nuts (less than 10 g). Kola nut size was highly correlated with germination rate ($r = 0.90$, $P = 0.03$) and emergence rate ($r = 0.96$; $P = 0.01$). This study showed that the germination and emergence capacity of kola nut was strongly influenced by its size.

Keywords: kola nut, size, germination rate, emergence rate

1. INTRODUCTION

Kola tree is native to the warm and humid regions of tropical Africa (Bodard, 1960). It belongs to the family of Malvaceae (Alverson et al., 1999). The genus *Cola* spp. contains more than 140 species of which the most used are *Cola nitida*, *Cola acuminata* and *Cola anomala* (Russel,

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1955; Mabberley, 2008). It is now widely grown in the West Indies, Brazil and Indonesia. Kola is grown on sandy-clay soils and is suitable for soils with low water retention capacity and low nutrient content (Oladokun, 1986).

Kola nuts are commonly used in some African ethnics groups as medicine and energizing plant (Legnate et al., 2010; Okoli et al., 2012). Due to the presence of alkaloids such as caffeine, kolatin and theobromine, nuts are also used in the pharmaceutical and food industries (Burkill, 2000; Lowe et al., 2014).

Kola nut plays a very important role in the economy of many West African countries such as Cote d'Ivoire, Nigeria and Ghana (Bonsson, 1983; Aloko-n'guessan, 2000). With an estimated production of 100,000 tons of fresh kola nuts per year with around $178 million, Cote d'Ivoire is the second largest producer and exporter of kola in the world (Aloko-n'guessan, 2000).

In Cote d'Ivoire, most of the production comes from kola trees grown in coffee and cocoa orchards. In recent years, National Centre for Agronomic Research has selected improved plant material for the establishment of pure kola orchards. In Cote d'Ivoire, several clones have been made; however, one of the major constraints of kola trees cultivation is the germination of kola nut. For Mbete et al. (2011), kola nuts have slow germination and the tree has a late entry into production. Nuts size under genetic control (Abbo et al., 1992; Duhy and Ake, 1999) is an important factor for germination and yield (Oladokun, 1986). According to Duhy and Ake (1999), medium-sized and large nuts showed the best germination capacity. The work of Gbedie et al. (2017) has shown the efficiency of soaking in water and injury of the kola nuts for the germination process. This study aims to determine the optimum size of kola nut, favorable to germinate in scarification and humidification conditions.

2. MATERIAL AND METHODS

2.1. Description of the study sites

The trial was conducted on the site of the nursery of National Centre for Agronomic Research (NCAR) of Man, located in the western part of Cote d'Ivoire (7°19.130'N 8°19.452'W).

2.2. Plant material

The plant material consisted of fresh kola nuts (150 kola nuts) harvested in the experimental field of National Centre of Agronomic Research located in Divo.

2.3. Experimental design and treatments

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The experimental design was a Fisher's block with three repetitions and five treatments. Kola nuts from all treatments were scarified and soaked in water during 48 hours. Thus, the treatments studied were as follows: T1=very small nuts (less than 10g); T2=small walnut (10-20g); T3=small to medium nuts (20-30g); T4=medium nuts (30-40g); T5=large nuts (40-50g) (Figure 1). 15(5x3) experimental units of 10 nuts each put the test in place.

Figure 1: Kola nuts of different size. (Gbedie, 2018)

2.4. Establishment of the test

The nuts were sown in three propagators on a substrate composed of decomposed red sawdust. Substrate and nuts were previously treated with Mancozeb (2kg/ha) and Cypermethrin (1L/ ha) to eliminate presence of weevils and fungi. During the test in the propagators, the average temperature was 25°C and the average humidity, 90%. For this study, germination rate and emergence rate were recorded 35 days and 65 days after sowing respectively.

2.5. Statistical analyzes

The data were subjected to one-way analysis of variance (ANOVA) using the GenStat Edition 17 software, after an angular transformation. The averages were separated using the least significant difference (LSD). Correlation calculations were also done using the GenStat Edition 17 software.

3. RESULTS

3.1. Effect of fresh kola nut size on germination rate

Analysis of variance on germination rate showed a significant difference (P=0.001) between nut size. Treatment ranking revealed three homogeneous groups. The first group consisted of large kola nuts that had the highest germination rate (100%). Medium nuts were the second group with a germination rate of 80%. The other types of nuts belonged to the third group with relatively low germination rates that ranged from 60 to 66% (Figure 2). The size of the fresh kola nut was positively correlated with the germination rate ($r = 0.90$; $P = 0.03$) and negatively correlated with the delay to reach 50% germination ($r = -0.72$; $P = 0.03$).

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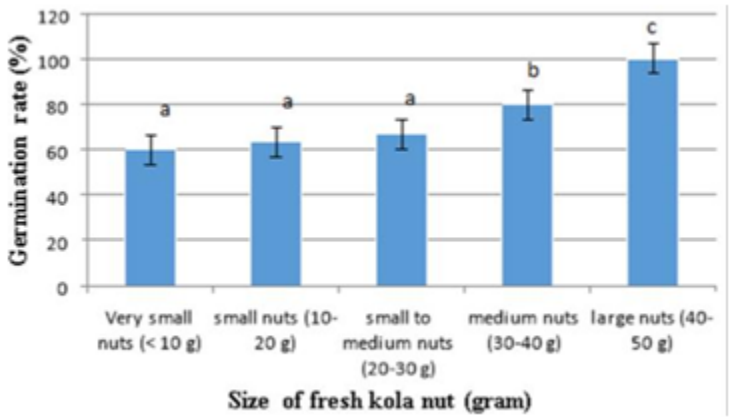
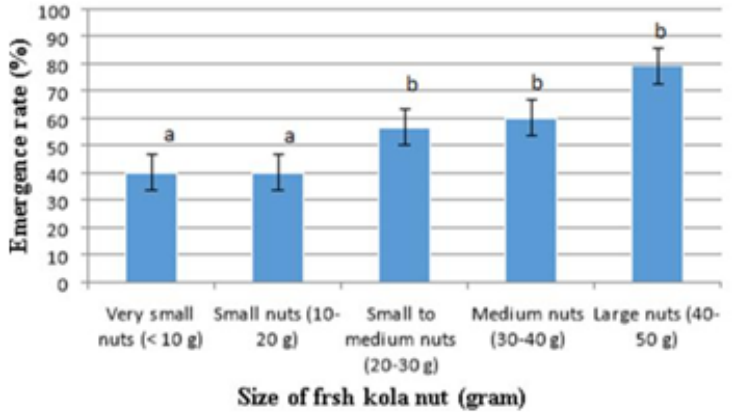


**Affected averages of the same letter are not significantly different at the 5% threshold.*

Figure 2: Germination rate of fresh kola nut.

3.2. Effect of fresh kola nut size on emergence rate

Analysis of variance on the emergence rate revealed a significant difference (P=0.04) between the nut types. The ranking of means showed two homogeneous groups. The first group consists of small and very small nuts. These nuts obtained emergence rate of less than 50%. The second group is the other types of nuts with emergence rates above 50% (Figure 3). The size of the fresh kola nut was positively correlated with the emergence rate (r = 0.96; P = 0.01) and negatively correlated with the delay to reach 50% emergence (r = - 0.94; P = 0.01).



**Affected averages of the same letter are not significantly different at the 5% threshold.*

Figure 3: Emergence rate of fresh kola nut.

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3.3. Modelling implication

The relationship between the kola nut size and the germination rate can then be modeled by an equation line:

$$Y = 1.0935X + 45.568, \text{ with } R^2=0.9117.$$

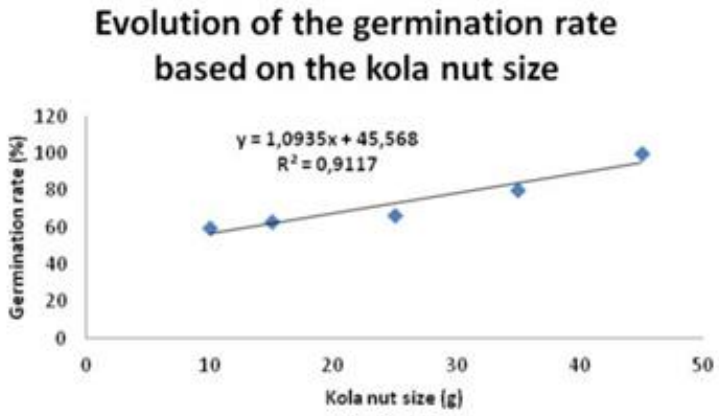

Figure 4: Evolution of the germination rate based on the kola nut size.

The results obtained also revealed a relationship between the kola nut size and the emergence rate. This relationship can be modeled by the equation line:

$$Y = 1.1049X + 26.073, \text{ with } R^2=0.9526.$$

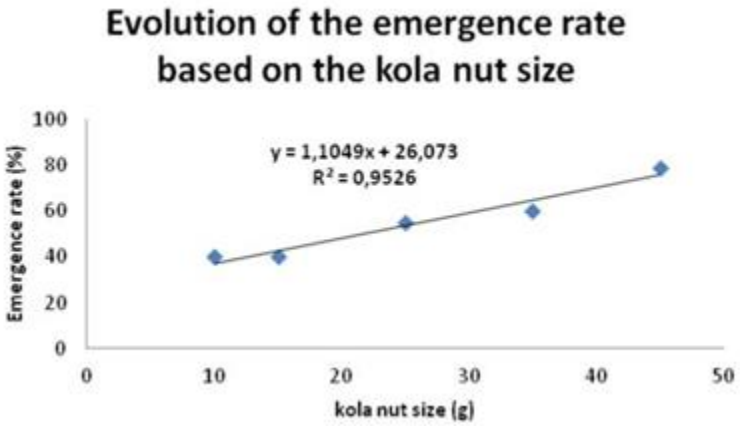

Figure 5: Evolution of the emergence rate based on the kola nut size.

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4. DISCUSSION

The objective of this study was to determine the optimum size of fresh kola nut, favorable to germinate in scarification and humidification conditions. The results showed that the highest germination rate (100%) was obtained from large kola nuts and the lowest with smaller nuts. These results are similar to those of Duhy and Ake (1999) who showed that size has a direct influence on the germination capacity of *C. nitida* seeds. This situation could be explained by the fact that the larger nuts have a much larger amount of initial reserves. In fact, cotyledon reserves are mobilized during metabolic transformations for seed germination (Harper, 1977; Duhy and Ake, 1999).

The study also highlighted the ability of large kola nut to emerge faster than other types of kola nut. According to Ellis (1992), Davidson et al., (1996), large nuts provide the energy needed for all biological processes that allow passage of embryo to young plant. Yusuf et al., (2014) found similar results on corn where the larger grains had larger embryos and high respiration rates resulting in faster emergence in small grains. In additon, it has been demonstrated by Sanderson et al., (2002) that grain size affects germination and emergence rates. The results of previous studies revealed that the very large grains obtained a better rate of germination and emergence compared to small grains (Anegbeh et *al.*, 2005; Whitlock et *al.*, 2011).

5. CONCLUSION

For this study, large nuts of *C. nitida* achieved the best germination rate and emergence rate. A strong relationship between kola nut size and germination rate and emergence rate also highlighted. Further experiments in other areas of cultivation of kola tree in Cote d'Ivoire should be done for accurate findings.

These results provide a possibility of predicting the germination rate and the emergence rate of kola nut based on size.

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