African Scientist Vol. 22, No. 2 June 30, 2021
Printed in Nigeria

1595-6881/2021 $10.00 + 0.00

http://www.niseb.org/afs

AFS2021008/22205

Effect of Soil Types and Mechanical Scarification on the Germination and Seedling Growth of *Cola nitida* Schott & Endl.

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(Received June 26, 2021; Accepted in revised form June 29, 2021)

ABSTRACT: The major problem in *Cola* propagation is related to seed germination and slow growth rate, hence this study was designed to ascertain the effect of soil types and mechanical scarification on the germination and seedling growth of *Cola nitida*. The experiment was a two factored experiment of 4 soil type (Topsoil, topsoil combined with carbonized sawdust (TSCSD), topsoil combined with river soil (TSRS) and River soil) and 2 scarification (Nicked and Whole seed) laid in a Completely Randomized Design (CRD) with 3 replicates. Twenty four viable *Cola* seeds were sown in black polyethene bags to determine the most suitable soil type for *Cola* germination and its subsequent growth. The mean germination time of *Cola nitida* seed was 52.67 days in riversoil and 29.8 days in topsoil. The result also revealed that mechanical scarification had no effect on the germination and seedling growth of *Cola nitida* but soil type had significant difference on the seedling growth of *Cola nitida*. Hence, the delay in *Cola nitida* germination is not as a result of seed coat impedance. The use of topsoil as germination medium and TSCSD as seedling growth medium for the propagation of *Cola nitida* is recommended.

Keywords: *Cola nitida*, Germination, Seedling growth, Soil types and Scarification.

Introduction

Kola nut is the seed kernel of a large African tree which belongs to the family Malvaceae, sub family Sterculioideae. About 40 *Cola* species have been described in West Africa. In Nigeria about 23 species are known. *Cola nitida* is the most commonly used species in the genus, and have the greatest economic importance (Lovejoy, 1980). *Cola nitida* known as "Obi gbanja" in Yoruba and "Goro" in Hausa was originally found along the coast of West Africa from Sierra Leone to Benin Republic with its highest frequency in the forest of Ivory Coast and Ghana (Nzekwe, 1961). The kola tree is an evergreen which can grow up to 25 meters tall. It has pale yellow flowers with purple stripes and star-shaped fruits with woody hulls. The leaves of *C. nitida* are shiny and light green in color. Kolanut is used as a masticatory stimulant by Africans and has numerous uses in social, religious, ritual and ceremonial functions by the natives in the forest region of Africa (Asogwa *et al*., 2006). Extracts of kola nuts bark have also been tested on various pathogenic bacteria such as: *Staphylococcus aureus*, *Proteus mirabilis*, *Escherichia coli* and showed inhibitory activity against these organisms (Ebana *et al.*, 1991). Kolanut has been an item of trade in West Africa and in the trans-saharan trade routes for many centuries (Egbe and Sobamiwa, 1989). Its uses have inevitably created a high demand in excess of its production (Oladokun, 1985).

The major difficulty in propagating *Cola* and other plants of the same genus is related to seed germination (Yakubu *et al.*, 2014). Seed germination and early seedling growth phases are considered critical for raising a successful crop as they directly determine the crop stand density and consequently the yield of resultant crop (Hossain *et al*., 2005). It has been indicated that seed germination, seedling growth, and survival percentage are governed by many intrinsic

and extrinsic factors and are species specific (Gunaga *et al*., 2011; Murali, 1997). Germination is slow, but under favourable conditions *C. nitida* germinates within 80 days (Opeke, 1992). Only few researchers have studied the germination problems of seeds and suggested various means of breaking its dormancy (Yoshiyama *et al.*, 1996, Baskin and Baskin, 2001). Hence, the aim of this study was to investigate the effect of mechanical scarification (nicked and whole seed) and most suitable soil type for germination and seedling growth of *Cola nitida*.

Materials and Methods

The experiment was conducted in the screen house of Michael Okpara University of Agriculture, Umudike, Abia State. Freshly matured fruits of *Cola nitida* were collected from a homestead in Amaputa village, Isiala Ngwa North, Abia State. The seeds were excised and subjected to seed viability test. Twenty four viable seeds were planted, with 12 seeds nicked with a clean kitchen knife while the other 12 seeds were planted whole.

Viable seeds were sown in black polythene bags containing 3 kg of the soil samples (Topsoil, Topsoil and Carbonized Saw Dust (TSCSD), Topsoil and Riversoil (TSRS) and Riversoil) each.

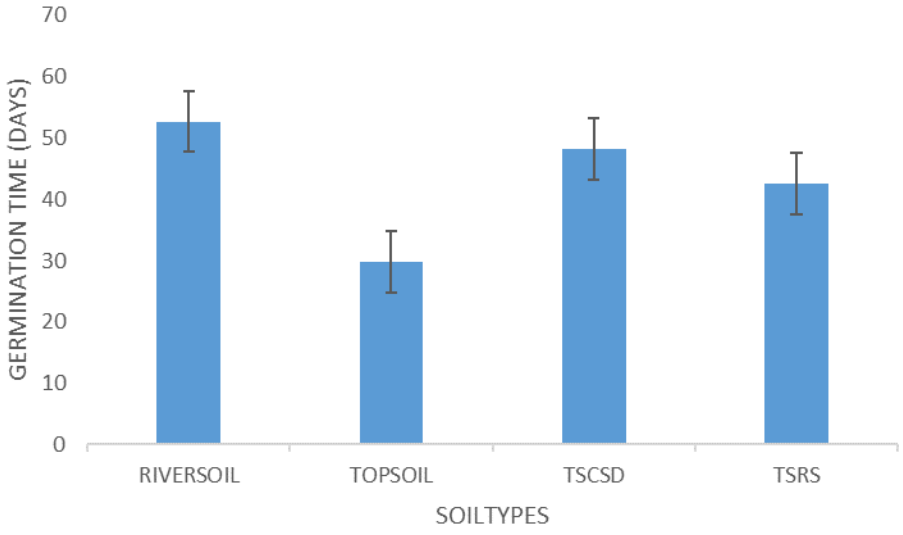
Germination time (days) was visually observed and recorded. While plant height, stem girth and number of leaves were taken at 2^{nd}, 4^{th}, 6^{th}, 8^{th}, 10^{th} and 12^{th} weeks after sprouting.

The experimental design was a 4 (soil type) × 2 (scarification) experiment laid out in a Completely Randomized Design (CRD) with 3 replications.

Data obtained from the experiment was subjected to General Linear Model (GLM) procedure using Statistical Analysis System (SAS) version 9.3. And the treatment means were separated using Least Significance Difference (LSD) at $P \leq 0.05$.

Results

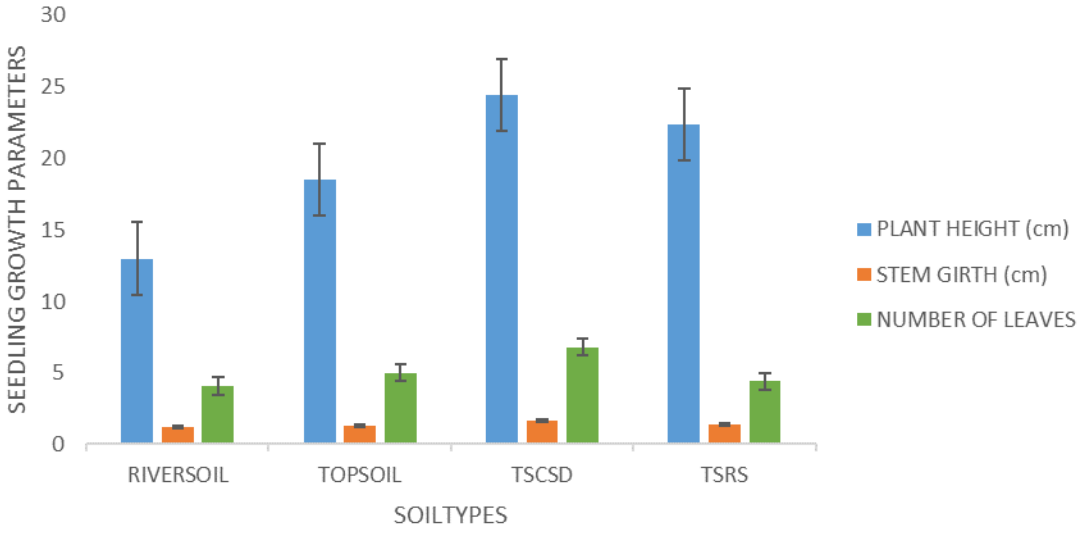
From this study, there was no significant difference at $P \leq 0.05$ among the soil types in the seed germination rate of *Cola nitida*. Although *Cola nitida* seed germinated in all soil type used, it was observed that seed sown in topsoil germinated faster than seed sown in river-soil with mean germination time of 29.8 days and 52.67 days respectively (Fig 1).



TSCSD = Topsoil combined with carbonized sawdust TSRS = Topsoil combined with River soil

Figure 1: Effect of soil types on germination time (days) of *Cola nitida*

In Fig 2; It was observed that TSCSD varied significantly ($p \leq 0.05$) from other soil types. TSCSD recorded the maximum means of plant height (24.42 cm), stem girth (1.67 cm) and number of leaves (6.8), while River soil recorded the minimum means of plant height (13 cm), stem girth (1.19 cm) and number of leaves (4.1).



*TSCSD = Topsoil combined with carbonized sawdust TSRS = Topsoil combined with River soil

Figure 2: Effect of Soil type on seedling growth of *Cola nitida*

Mechanical scarified (nicked) seed had no significant difference at $P \leq 0.05$ from the un-scarified (whole) seed in both germination and seedling growth of *Cola nitida* (Table I). The mean germination time of nicked seed was higher than that of whole seed.

Table I: Effect of mechanical scarification on the germination and seedling growth of *Cola nitida*

Scarification	Germination time (days)	Mean plant height (cm)	Mean stem girth (cm)	Mean number of leaves
Nicked seed	45.30 ± 28.84[a]	19.34 ± 2.75[a]	1.37 ± 0.09[a]	5.32 ± 0.84[a]
Whole seed	42.36 ± 25.74[a]	19.21 ± 2.88[a]	1.38 ± 0.04[a]	4.80 ± 1.05[a]

* Means with the same letter are not significantly different at $P \leq 0.05$; Values are mean ± standard deviation

Discussion

From this study, there was no significant difference at $P \leq 0.05$ among the soil type in the seed germination rate of *Cola nitida*. Topsoil had the least germination time of 29.8 days, hence proved to be the best germination medium when compared with the other soil type used in this study. This result supports the work of Fredrick and Uzoma (2018) on the effect of soil amendments on the germination and early seedling growth on *Annona muricata* Linn. They reported earliest germination emergence in top soil.

The presence of the carbonized saw dust in the top soil increased the fertility level of the top soil and hence could be responsible for the excellent performance of TSCSD soil type as the best seedling growth medium in this study. This result is in agreement with that of Jensen (1988), where he concluded that height growth has a direct relationship with the number of leaves produced by seedlings and the diameter can also serve as an expression of soil fertility level. Researchers have reported the favourable effect that organic growing medium (saw dust) have on plant growth (Maboko and Du-Plooy, 2013; Tzortzakis and Economakis, 2008). However, Omokhua *et al.*, (2015) obtained

highest stem girth (diameter) on topsoil over other treatments (coarse sand, sawdust and fine sand) when working on *Terminalia ivorensis*.

There was no significant difference in the germination and seedling growth of nicked and whole *Cola nitida* seeds. This could mean that the delay in germination of *Cola nitida* seed is not as a result of seed coat impedance but other dormancy factors. This report confirms the beliefs of Oladokun (2000) that the untimely and uneven germination of *C. nitida* is more of non-conducive intrinsic causes rather than seed coat effect. Hence, *Cola nitida* seed could be propagated with or without mechanical scarification as Rostami and Shasavar (2009) reported that mechanical treatment had no effect on germination percentage or germination rate of olive cultuivars. Mean plant height of nicked seed was slightly higher than that of the whole seed. This is in conformity with the result of Edward *et al.* (2014) on *Acacia polyacatha* who recorded higher plant height on nicked seeds.

Conclusion

Soil types had no significant difference on the germination of *Cola nitida* seed, hence any of the four soil types could be used for the germination of *Cola nitida* seed but the use of topsoil as the germination medium and TSCSD soil type being an excellent medium for the seedling propagation is recommended. Mechanical scarification had no effect on the germination and seedling growth of *Cola nitida*, thus *Cola nitida* delay in germination is not as a result of seed coat impedance.

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