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Seedling production of gurguéia nut (*Dypterix lacunifera* Ducke) I: Seed germination and suitable substrates for seedlings

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Abstract

Methods of seed germination and suitable substrates for seedling growth of gurguéia nut (*Dipteryx lacunifera*) were studied in the present work. The following methods of seed germination i.e. I and II) Room temperature water soak for 24 and 48 hours; III, IV, V and VI) hot water soak, for 5, 10, 15 and 20 minutes, respectively; and VII) mechanical scarification, were studied. The studied substrates were: S_1) red Oxisol:sand:bovine manure (1:1:1); S_2) red Oxisol:sand:goat manure (1:1:1); S_3) red Oxisol:decomposed buriti stem:bovine manure (1:1:1); S_4) red Oxisol:decomposed buriti stem:goat manure (1:1:1); and S_5) washed sand. No seed germination was recorded for methods IV, V and VI, whereas for the other methods, values ranged from 70% to 85%, with the highest average being registered for room temperature water soak for 24 hours. Excluding S_3, emergence parameters were better as S_1 shifted to S_5 with the latter one was found to be best. Substrate affects seedling formation of gurguéia nut, indicating that washed sand may be used in this process.

Keywords: *Dipteryx lacunifera*; Seed; Growing media.

Introduction

Gurguéia nut (*Dipteryx lacunifera* Ducke, Leguminoseae) is a species native to Piauí and Maranhão States, Brazil (Lima, 1989) commonly propagated by seeds. Gurguéia nut is a potential fruit species because its nut is a natural source of energy, carbohydrates, proteins and fibers (Carvalho et al., 2008). Furthermore the fruit skin contains terpenes and essential oils of high quality that could be used by the pharmaceutical industry (Vieira Jr et al., 2007). As also observed for all potential fruit species, basic agronomic information about plant propagation, physiology and nutrition is needed for development of commercial orchards of gurguéia nut. As there are no data on the seed germination and seedling emergence of this species, the objective of this study was to evaluate methods of seed germination and suitable substrate for seedling formation of *D. lacunifera*.

Materials and Methods

Seeds of Gurgueia nut (*D. lacunifera* Ducke) were used in these studies. Seeds were manually extracted from mature fruits released from farms in Bom Jesus, Piauí State, Brazil.

Two studies were conducted in duplicate from November 2008 to January 2009. For the first series of experiments i.e. methods for seed germination, a complete randomized design with seven treatments was adopted, with five replications each consisting of 10 seeds. The methods for seed germination were: I and II) Room temperature water soak for 24 and 48 hours, respectively; III, IV, V and VI) hot water soak, for 5, 10, 15 and 20 minutes, respectively; and VII) mechanical scarification of the micropylar pole of the testa with sandpaper No.120. Seeds were sown in wet filter paper, kept under room temperature ranging from 25 to 28 ºC and washed once daily. For the second series of experiments i.e. emergence studies they were carried out in a canvassed shelter under 50% of luminosity using a complete randomized design with five treatments (substrates) with five replications each consisting of 10 seeds (seedlings). The substrates studied were: S_1) red Oxisol:sand:bovine manure, at a 1:1:1 ratio; S_2) red Oxisol:sand:goat manure, at a 1:1:1 ratio; S_3) red Oxisol:decomposed buriti (*Mauritia vinifera,* Mart.) stem:bovine manure, at a 1:1:1 ratio; S_4) red Oxisol:decomposed buriti stem (*Mauritia vinifera,* Mart.): goat manure, at a 1:1:1 ratio; and S_5) washed sand. The naturally decomposed buriti stem was obtained from swamps of Bom Jesus County.

Seed germination percentage (%) and the germination rate were determined according to Maguire (1962). Germination was daily recorded and seeds were regarded as germinated when the radicle was at least equal to half seed width; b). Seedling emergence (%) and emergence rate were calculated following Maguire (1962) instructions, but seedlings were considered as emerged when they became visible from the substrate surface. The following variables were also registered: plant height (cm), stem diameter (mm): measured with a digital paquimeter (300 mm/12”-0.01 mm/0005”), root and shoot dry matter (g), root length (cm) and root volume (cm^3), performed by the provette method.

Two batches of 25 seeds were dried at 85±3 ºC for 48 hours to determine the initial humidity of seeds, which averaged about 11.58%.

Statistical analyses included analysis of variance and mean separation using Tukey’s test and terms were considered significant at $P\leq0.01$.

Results and Discussion

Gurguéia nut seed germination was remarkably affected by the method used for seed germination. For the following methods: hot water soak for 10, 15 and 20 minutes, none of the seeds germinated until the end of the experiment. For those methods which accompanied with seed germination, room temperature water soak for 24 hours (Table 1), presented the highest average. According to Koorneef et al. (2002) numerous leguminous species can be treated in this manner for example, acacia, albizia, and mesquite. As seed germination was not significantly affected by mechanical scarification of nuts, seed coat does not seem to impose any restriction in Gurguéia nut on radicle protrusion, however, Guimarães et al. (2008) observed that cracking seed tegument and removing the tegument promoted respectively 56% and 54.7% of seed germination of gurguéia nut which is not observed in our experiments. The inhibitory effect of the seed coat on seed germination may be caused by several possible mechanisms, including mechanical constraint, prevention of water and oxygen uptake, and retention or production of chemical inhibitors (Taiz and Zeiger, 2004). As also observed for seed germination (Table 1), the germination rate was not influenced by the method for seed germination with a higher rate for HWS for five minutes.

Table 1. Average seed germination and germination rate of gurguéia nut as a function of the methods for seed germination. Bom Jesus, Brazil, 2011.

Method for seed germination	Seed germination (%)	Germination rate
RTWS for 24 hours	85.00[a]	2.509[a]
RTWS for 48 hours	70.00[a]	2.314[a]
HWS for 5 minutes	72.50[a]	2.988[a]
Mechanical scarification	77.50[a]	2.841[a]
SMD	35.6	1.65
VC	22.24	29.5

RTWS = room temperature water soak; HWS = hot water soak; SMD = Significant Minimum Difference; VC = variation coefficient; Averages followed by the same letter do not differ by Tukey's test at P≤0.01.

No seedling emergence occurred on Substrate S_4. Substrate had no statistical influence on this variable (Table 2) and it was recorded that washed sand (S_5) promoted at least 10% more seedling emergence than other substrates. The lack of significance is in agreement with other studies about other fruit species such as *Hancornia speciosa,* another leguminous species (Santos and Nascimento, 1999). On the other side, Yang et al. (2008) reported that soil type and depth affects seed germination and seedling emergence of *Camellia nitidissima*.

Table 2. Seedling emergence (SE), emergence rate (ER), plant height (PH), stem diameter (SD), shoot dry mass (SDM), root length (RL), root volume (RV) and root dry mass (RDM) of gurguéia nut as a function of substrate. Bom Jesus, Brazil, 2011.

Substrate	SE (%)	ER	pH (cm)	SD (mm)	SDM (g)	RL (cm)	RV (cm^3)	RDM (g)
S1	19.55[a]	1.05[a]	4.64[b]	0.24[a]	0.60[b]	9.53[b]	0.82[a]	0.30[a]
S2	17.89[a]	0.91[a]	4.57[b]	0.22[a]	0.30[b]	10.42[b]	1.15[a]	0.33[a]
S4	18.43[a]	1.12[a]	6.33[ab]	0.30[a]	0.82[b]	15.48[b]	1.17[a]	0.45[a]
S5	30.80[a]	2.57[a]	6.64[a]	0.39[a]	1.77[a]	32.15[a]	2.12[a]	1.08[a]
SMD	23.23	2.18	1.88	0.17	0.92	7.09	1.55	0.96
VC	23.23	91.22	55.86	17.64	27.88	19.00	49.97	80.67

SMD = Significant Minimum Difference; VC = variation coefficient; Averages followed by the same letter do not differ by Tukey's test at P≤0.01.

Emergence rate was also not influenced by the substrates studied (Table 2). It is important to detach that shoot tip of gurguéia nut emerges first that characterizes a hypogeous germination. For plant height, stem diameter and shoot dry mass, S_4 and S_5 substrates inherently presented higher averages (Table 2). Furthermore, sand is the heaviest substrate used in horticulture with a cubic foot of dry sand weighing about 45 kg (Horn, 1996) and contains virtually no mineral nutrients, but promoted seedling emergence better thanother substrates.

For root variables (Table 2) it was verified differences among the substrates studied, with the average differences between the lowest (S_1) and the highest (S_5) were 29.64% for root length, 38.68% for root volume and 27.78% for root dry mass. This result can promote a strong influence on plant development (Taiz and Zeiger, 2004) because plants obtain most of their nutrients and water by roots.

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