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EFFECT OF PRE-SOWING TREATMENTS, SEED ORIENTATION AND THEIR INTERACTIONS ON SEED GERMINATION AND SEEDLING GROWTH OF AFRICAN MAHOGANY (*KHAYA SENEGALENSIS* (DESR.) A. JUSS) TREE

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ABSTRACT: An investigation was consummated under shade condition at the nursery of Orman Botanical Garden, Giza, Egypt during 2020 and 2021 seasons to study the effect of pre-sowing treatments; i.e. seeds without any treatment (as control), soaking in tap water for 24 h at ambient temperature and soaking in hot water (70-80 °C) for 24 h, seed orientation treatments; horizontal with the micropyle oriented laterally and vertical with the micropyle positioned either upwards or downwards and their interactions on germination characters and seedling growth traits of African mahogany timber tree (*Khaya senegalensis* (Desr.) A. Juss) seeds. The results indicated that seeds soaked in hot water for 24 h failed to germinate in both seasons, while those soaked in tap water at room temperature for 24 h gave the highest percent of germination, the least No. days to either maximum or 50% germination as well as the best means of germination rate index, vigour index, seed viability and plumule length compared to control in the two seasons. Horizontal sowing method recorded the maximal germination percent, quickest germination, strongest vigour index and seed viability as well as the longest plumule length and followed by vertical one, in which the micropyle oriented upwards. So, the best results at all were obtained from combining soaking the seeds in tap water treatment and positioned them horizontally. A similar trend to that of germination characteristics was also occurred regarding seedling growth parameters. Accordingly, it can be proposed to soak *Khaya senegalensis* seeds in ordinary water pre-sowing for 24 h at ambient temperature and embedding them horizontally at 2 cm depth with the micropyle positioned laterally to obtain better germination and the best growth traits of the seedlings.

Keywords: African mahogany, *Khaya senegalensis* (Desr.) A. Juss, seed germination, pre-sowing treatments, seed orientation, seedling growth.

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INTRODUCTION

African mahogany species has the highest economical value among various species of Meliaceae Fam. due to its better timber traits and using its wood for carpentry and many other constructions. It was also used for road landscaping and for curing some local diseases in its native-home (Joffe, 2007).

The main and easy way for the propagation of *K. senegalensis* is the seeds,

but seeds of this species have polymorphism phenomenon and dormancy mechanism (Mahgoub, 2002). El-Tahir (1999) reported that mahogany seeds exist in two sizes, the large ones non-dormant, while the small ones are dormant. Seeds from upper and lower position inside the locules are the best to be used. Seed polymorphism and dormancy are the major obstacles to uniform germination and seedling growth of such timber tree. So, it is obligate to find out feasible and practical method for dormancy breaking (Mahgoub, 2002). In this regard, Algunaid *et al*. (2013) concluded that soaking *K. senegalensis* seeds in tap water for 18 h and GA_3 (0.01% conc.) for 2 h were the best treatments for breaking dormancy and accelerating germination. Likewise, Egbewhole *et al*. (2018) revealed that seeds of *K. senegalensis* from different locations soaked in H_2O for 24 h and then in GA_3 solution (500 ppm) for the same time (24 h) showed the least different performances with the best germination percent. On *Khaya anthotheca*, Shmidt (2000) mentioned that soaking the seeds in a warm water (50-60 °C) speed up germination within 2-6 weeks. On the contrary, Lemmens (2020) reported that *K. senegalensis* can be propagated by seeds within 18-20 days without pre-treatment before sowing.

Effects of pre-sowing treatments on seed germination and the initial growth of the resulted seedlings were also discovered by Vari *et al*. (2007) on *Sesbania* spp., Souza *et al*. (2012) on *Schizolobium parahyba*, Pant and Chauhan (2013) on *Cassia tora*, Kavita and Kumar (2014) on *Stylosanthes guianensis*, Shahin *et al*. (2015 a) on *Dillenia indica*, Shahin *et al*. (2015 b) on *Calliandra haemotosephala*, Shahin and El-Tayeb (2016 a) on golden cane palm, Shahin and El-Tayeb (2016 b) on Pygmy date palm and Shahin *et al*. (2017) on Baobab.

Moreover, seed orientation also had a marked effect on germination characters (Rizwan and Aftab, 2018) on *Jatropha curcas*. In this regard, Kader and Seethalakshmi (2009) declared that sowing the seeds of *Swietenia macrophylla* horizontally with the micropyle oriented laterally scored the highest percent of germination (92%) versus 87% by vertical sowing method. Seeds, however, sown inverted with the micropyle oriented downwardly gave the least germination percentage (11%). Further, plant survival was higher in horizontal sowing (92%), followed by vertical one (82%) and then inverted sowing (11%). Germination in the horizontal method was earlier (13 days after sowing) than that the of the vertical one (14 days after sowing) and the inverted position method (11 DAS). Similar observations were also detected by Lal and Karnataka (1993) on *Quercus leucotrichophora*, Swaminathan *et al*. (1993) on *Pongamia pinnata*, Rawat and Nautiyal (1999) on *Quercus leucotricophora*, Rambabu *et al*. (2006) on *Givotia rottleriformis*, Silva and Carvalho (2007) on *Citrus limonia* and *Poncirus trifoliata* x *C. Paradisi* and Ojha *et al*. (2010) on *Jatropha curcas*.

This study aims to evaluate the role of seed orientation, pre-sowing treatments and their interactions in improving seed germination and seedling growth of African mahogany timber tree.

MATERIALS AND METHODS

This experiment was performed under shade at the nursery of Orman Botanical Garden, Giza, Egypt during 2020 and 2021 seasons to reveal the effect of seed position, some pre-sowing treatments and their combinations on germination characteristics of Senegal mahogany forest tree and quality of the resulted seedlings.

Thus, the globose, valved fruits of *Khaya senegalensis* (Desr.) A. Juss. were collected from an adult tree grown in Giza Zoo on July for each season and sun dried to release the seeds. The seed weight varied from 0.1 to 0.26 g. Quick sterilization for the outer surface was done by soaking the seeds in 5% solution of Na-hypochlorite for 1 minute, followed by rinsing with sterile

distilled water for several times, thereafter the seeds were subjected to:

1. Pre-sowing treatments included No treatment (as control) and soaking in either tap water for 24 hours at room temperature (max. temp. 35.5-36.7 °C) or hot water (70-80 °C) for 24 hours.
2. Seed orientation: as the seeds were sown in 3 different orientations; horizontally by scattering the seeds under the soil surface at a depth of 2 cm with the micropyle positioned laterally and vertically by embedding the seeds 2 cm deep in the soil mixture with the micropyle positioned either upwards or downwards.
3. Interaction treatments: the treatments of both pre-sowing and orientation were combined factorially to include 9 interaction treatments.

The treated seeds and those of control were sown on July, 15th for every season in 16-cm-diameter plastic pots (10 seeds/ pot) filled with about 1.7 kg of sand and clay soil mixture at equal volumetric parts (1:1, v/v). The physical and chemical properties of the soil mixture used in the two seasons are shown in Table (a).

A factorial experiment based on a complete randomized design, replicated thrice was accomplished in both seasons, where each pot contained 10 seeds stands for one replicate (Mead *et al*., 1993). A visible appearance of plumule is used as a guide for germination. After complete arrest of germination (at the end of September), germination data were recorded as follows for every season:

1. Germination percentage (G. %) estimated from the following equation:

   G. % = No. germinated seeds/total No. sown seeds × 100.
2. Germination velocity (G.V.) in days, which equals the average number of days from sowing till the emergence of the last plumule.
3. Mean germination rate (MGR) in days, which equal the mean number of days to score 50% of total germination (Odetola, 1987).
4. Germination rate index (GRI), which was calculated from the Bartled equation mentioned by Hartman and Kester (1983):

   GRI = A + (A + B) + (A + B + C) + … /N (A + B + C ...), where: A, B, C, ... No. germinated seeds counted at different times, and N is number of times at which germinated seeds were counted.
5. Vigour index (VI) = G. % × mean length of plumule (Selvaraju and Selvaraj, 1994).
6. Seed viability (SV), the No. survived seedlings in each treatment after excluding the deteriorated and dead ones (Odetola, 1987).
7. Mean length of plumule (cm) measured after a week from emergence.

One month later (on October, 30th), seedling samples from different treatments were gently lifted to assess stem length (cm), number of leaves/seedling, leaf area (cm^2), root length (cm), as well as leaves and roots fresh and dry weights.

Table a. The physical and chemical properties of the soil mixture used in the two seasons (2020 and 2021).

Soil mixture	Particle size distribution (%)				S.P.	E.C. (dS/m)	pH	Cations (meq/l)			
	Coarse sand	Fine sand	Clay	Silt				Ca^{++}	Mg^{++}	Na^{+}	K^{+}
Sand + clay mixture	37.4	31.5	10.5	20.6	26.3	3.5	7.9	18.7	14.2	32.2	0.9
	Anions (meq/l)				Macro-and micro-elements (ppm)						
	HCO_3^-	CO_3^{--}	Cl^-	SO_4^{--}	N	P	K	Fe	Zn	Mn	Cu
	5.15	--	81.9	5.5	17.8	3.7	8.5	4.1	0.69	1.33	0.21

Data were then tabulated and subjected to analysis of variance using computer program of SAS Institute (2009), whereas means comparison was achieved by Duncan's New Multiple Range Test at P= 0.05 (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Effect of pre-sowing treatments, seed orientation and their interactions on:

1. Germination characteristics and plumule length:

Data presented in Table (1) show that seeds soaked in hot water for 24 h failed to germinate in both seasons. This may be attributed to either the proportional high of the used hot water temperature (70-80 °C) which harmed the embryo, or detaching the lens from the coat and preventing water absorption in hot water-treated seeds (Souza *et al*., 2012). In this regard, Vari *et al*. (2007) on *Sesbania* spp. mentioned that hot water (80 °C) deteriorated germination due to increasing the percent of abnormal or dead seeds. Likewise, Kavita and Kumar (2014) found that treating *Stylosanthes guianensis* cv. Cook seeds with hot water exhibited maximum death.

On the other side, seed soaking in tap water at ambient temperature for 24 h, gave the highest % of germination, which were 65.37 and 70.25% against 31.03 and 31.43% for control in the first and second seasons, respectively. The least number of days to either maximum or 50% germination (G.V. and MGR in days) was also attained in the two seasons by soaking the seeds in tap water (24 h) treatment, which gave as well the best means of germination rate index (GRI) as a real indicator for accelerating germination, vigour index (VI), seed viability (SV) and plumule length compared to control in both seasons, as shown in Tables (1 and 2). Improving germination by soaking in tap water may be ascribed to leaching out the phenolic inhibitors from the seed coat of *K. senegalensis* (Algunaid *et al*., 2013).

Seed orientation also exerted a clear influence on the different germination characters (Tables, 1 and 2), as the seeds positioned horizontally scored the maximal percent of germination (76.85% in the 1st season and 75.67% in the 2nd one), followed by vertical position method (upward). Besides, horizontal sowing achieved the speediest germination, greatest vigour index and seed viability and the longest plumule length relative to the other methods. The vertical sowing (upwards) method occupied as well the second rank, while the least values of the previous germination parameters were recorded by the vertical sowing method (downwards) compared with the other methods in both seasons. This is possibly because of the water is in close contact with the seeds and easily imbibed by the embryo in case of sowing horizontally or upwards vertically. In this concern, Kader and Seethalakshmi (2009) noticed that *Swietenia macrophylla* seeds sown horizontally gave the maximal germination and survival percentages (92%), followed by the vertical sowing method (87%). On the forest tree *Givotia rattleriformis*, Rambabu *et al*. (2006) stated that placing embryos upright on the MS medium containing 30 g/l sucrose attained 100% germination. Ojha *et al*. (2010) reported that sowing *Jatropha curcas* seeds vertically with radical emerging point positioned upward gave 77.08% germination.

Combining soaking in tap water for 24 h and horizontal sowing gave the utmost high germination percent (97.93 and 100.00% in the first and second seasons, successively), followed by interacting between tap water treatment and vertical sowing with the micropyle oriented upwards, which scored 86.50 and 97.00% germination in both seasons, consequently. The least germination values in the two seasons were however found due to tap water treatment + vertical sowing with micropyle facing downwards combination. A similar trend was also obtained concerning the means of the other germination traits measured in this study (Tables, 1 and 2), where tap water treatment

Table 1. Effect of seed orientation, pre-sowing treatments and their interactions on some germination traits of *Khaya senegalensis* (Desr.) A. Juss. during 2020 and 2021 seasons.

Pre-sowing treatments	Seed orientation															
	Horizontal	Vertical (up)	Vertical (down)	Mean	Horizontal	Vertical (up)	Vertical (down)	Mean	Horizontal	Vertical (up)	Vertical (down)	Mean	Horizontal	Vertical (up)	Vertical (down)	Mean
	Germination (%)				Germination velocity (days)				Mean germination rate (days)				Germination rate index			
First season: 2020																
Control	55.76 c	30.00 d	7.33 e	31.03 B	45.50 c	47.73 b	51.80 a	48.34 A	40.00 a	-	-	40.00 A	0.600 b	0.663 a	0.671 a	0.645 A
Tap water*	97.93 a	86.50 b	11.67 e	65.37 A	21.33 f	24.50 e	28.76 d	24.86 B	16.50 c	18.97 b	-	17.74 B	0.490 d	0.493 d	0.569 c	0.517 B
Hot water**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean	76.85 A	58.25 b	9.50 C		33.42 C	36.12 B	40.28 A		28.25 A	18.97 B	-		0.545 B	0.578 AB	0.620 A	
Second season: 2021																
Control	51.33 b	32.96 c	10.00 d	31.43 b	39.73 b	41.98 b	52.00 a	44.57 A	39.00 a	-	-	39.00 A	0.600 a	0.600 a	0.633 a	0.611 A
Tap water*	100.00 a	97.00 a	13.76 d	70.25 A	18.56 e	23.67 d	33.50 c	25.23 B	16.33 b	16.00 b	-	16.17 B	0.443 c	0.456 c	0.551 b	0.483 B
Hot water**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean	75.67 A	64.98 B	11.88 C		29.12 C	32.83 B	42.75 A		27.67 A	16.00 B	-		0.522 B	0.528 B	0.592 A	

*** Soaking in tap water for 24 hours; ** Soaking in hot water for 24 hours·**

Means followed by the same letter in a column or row don't significantly differ according to Duncan's New Multiple Range Test at 5 % level·

Table 2. Effect of seed orientation, pre sowing treatments and their interactions on vigour index, seed viability and plumule length of *Khaya senegalensis* (Desr.) A. Juss. during 2020 and 2021 seasons.

Pre sowing treatments	Seed orientation											
	Horizontal	Vertical (up)	Vertical (down)	Mean	Horizontal	Vertical (up)	Vertical (down)	Mean	Horizontal	Vertical (up)	Vertical (down)	Mean
	Vigour index				Seed viability				Plumule length (cm)			
First season: 2020												
Control	49.07 c	18.30 d	4.40 f	23.92 B	5.33 b	3.11 bc	1.00 c	3.11 B	0.88 bc	0.61 c	0.60 c	0.70 B
Tap water*	142.00 a	115.05 b	12.37 e	89.81 A	9.33 a	8.67 a	2.00 c	6.67 A	1.45 a	1.33 a	1.06 b	1.28 A
Hot water**	-	-	-	-	-	-	-	-	-	-	-	-
Mean	95.54 A	66.68 B	8.39 C		7.33 A	5.89 B	1.50 C		1.17A	0.97 B	0.83 C	
Second season: 2021												
Control	50.31 b	28.02 c	7.00 d	28.44 B	6.00 b	3.76 bc	1.33 c	3.70 B	0.98 bc	0.85 c	0.70 c	0.84 B
Tap water*	139.00 a	131.92 a	15.14 d	95.35 A	10.00 a	9.33 a	2.67 c	7.33 A	1.39 a	1.36 a	1.10 b	1.28 A
Hot water**	-	-	-	-	-	-	-	-	-	-	-	-
Mean	94.66 A	79.97 B	11.07 C		8.00 A	6.55 B	2.00 C		1.19 A	1.11 AB	0.90 B	

*** Soaking in tap water for 24 hours; ** Soaking in hot water for 24 hours.**

Means followed by the same letter in a column or row don't significantly differ according to Duncan's New Multiple Range Test at 5 % level.

+ horizontal sowing method interaction gave the best results in both seasons. This may be referred to lump the advantages of both soaking in tap water leached out the coat inhibitors and horizontal sowing with the lateral lying of micropyle which remains water in close contact with the seeds.

The previous gains are in accordance with those postulated by Swaminathan *et al*. (1993) on *Pongamia pinnata*, Rawat and Nautiyal (1999) on *Quercus leucotricophora*, Rambabu *et al*. (2006) on *Givotia rottleriformis,* Shahin *et al*. (2015 a) on *Dillenia indica*, Shahin and El-Tayeb (2016 a and b) on *Chrysalidocarpus lutescens* and *Phoenix robelenii*, Shahin *et al*. (2017) on Baobab and Rizwan and Aftab (2018) On *Jatropha curcas*.

2. Seedling growth characters:

As shown in Tables (3 and 4), a trend similar to that of germination criteria was also observed in relation to seedling growth attributes, where the longest stem and root (cm), greatest leaf area (cm^2), highest No. leaves/seedling and heaviest fresh and dry weights of leaves and roots (g) were achieved either by soaking in tap water for 24 h treatment relative to unsoaking treatment (control) or by horizontal and vertical (upwards) sowing orientations compared to the vertical (downwards) method in the two seasons. Thus, the best seedling growth was recorded in both seasons by the synergism between soaking in tap water treatment and lying the seeds in soil mixture either horizontally with the micropyle positioned laterally or vertically with the micropyle facing upwards, but the upper hand was for the former combination that in general registered, the highest values in most cases of both seasons.

Improving vegetative and root growth by the combinations mentioned above may be resulted from the early germination caused under such treatments, consequently saving more time for the produced seedlings to grow well, while seeds subjected to other treatments are still dormant. These results, can be however supported by those discovered by Kader and Seethalakshmi (2009) on *Swietenia macrophylla*, Algunaid *et al*. (2013) on *Khaya senegalensis*, Egbewole *et al*. (2018) on *K. senegalensis* and Rizwan and Aftab (2018) on *Jatropha curcas*.

From the aforementioned findings, it is recommended to soak seeds of *Khaya senegalensis* in tap water for 24 h and sowing them horizontally at a depth of 2 cm with the micropyle positioned laterally to gain better germination characteristics and higher seedling quality.

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Table 3. Effect of seed orientation, pre-sowing treatments and their interactions on growth traits of *Khaya senegalensis* (Desr.) A. Juss. during 2020 and 2021 seasons.

Pre-sowing treatments	Seed orientation															
	Horizontal	Vertical (up)	Vertical (down)	Mean	Horizontal	Vertical (up)	Vertical (down)	Mean	Horizontal	Vertical (up)	Vertical (down)	Mean	Horizontal	Vertical (up)	Vertical (down)	Mean
	Stem length (cm)				No. leaves/seedling				Leaf area (cm^2)				Root length (cm)			
First season: 2020																
Control	5.97 c	4.45 d	3.66 e	4.69 B	3.67 c	3.33 c	2.67 d	3.22 B	3.85 b	2.90 b	2.90 b	3.22 B	13.61 b	11.78 c	9.50 d	11.63 B
Tap water*	9.80 a	9.67 a	7.73 b	9.07 A	7.00 a	6.33 a	5.00 b	6.11 A	7.60 a	7.18 a	7.20 A	7.33 A	17.50 a	17.36 a	13.95 b	16.27 A
Hot water**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean	7.89 A	7.06 AB	5.70 B		5.34 A	4.83 AB	3.84 B		5.73 A	5.04 B	5.05 B		15.06 A	14.57 AB	11.73 B	
Second season: 2021																
Control	5.99 c	5.00 cd	3.99 d	4.99 B	4.33 c	4.00 c	3.20 d	3.84 B	4.17 b	3.50 b	3.35 b	3.67 B	12.63 b	11.50 c	9.33 d	11.15 B
Tap water*	12.36 a	11.67 a	8.78 b	10.94 A	7.60 a	7.33 a	5.67 b	6.87 A	7.76 a	7.10 a	7.00 a	7.29 A	17.55 a	16.97 a	13.50 b	16.01 A
Hot water**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean	9.18 A	8.34 AB	6.39 B		5.97 A	5.67 AB	4.44 B		5.97 A	5.30 B	5.18 B		15.09 A	14.24 AB	11.42 B	

*** Soaking in tap water for 24 hours; ** Soaking in hot water for 24 hours.**

Means followed by the same letter in a column or row don't significantly differ according to Duncan's New Multiple Range Test at 5 % level.

Table 4. Effect of seed orientation, pre-sowing treatments and their interactions on leaves and roots fresh and dry weights of *Khaya senegalensis* (Desr.) A. Juss. during 2020 and 2021 seasons.

Pre-sowing treatments	Seed orientation															
	Horizontal	Vertical (up)	Vertical (down)	Mean	Horizontal	Vertical (up)	Vertical (down)	Mean	Horizontal	Vertical (up)	Vertical (down)	Mean	Horizontal	Vertical (up)	Vertical (down)	Mean
	Leaves fresh weight (g)				Roots fresh weight (g)				Leaves dry weight (g)				Roots dry weight (g)			
First season: 2020																
Control	0.18 c	0.15 c	0.12 c	0.15 B	0.03 c	0.02 c	0.01 c	0.02 B	0.04 c	0.03 c	0.02 c	0.03 B	0.015 c	0.012 c	0.010 c	0.012 B
Tap water*	0.72 a	0.64 ab	0.50 b	0.62 A	0.20 a	0.19 a	0.15 b	0.18 A	0.18 a	0.17 a	0.13 b	0.16 A	0.071 a	0.071 A	0.057 b	0.066 A
Hot water**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean	0.45 A	0.40 A	0.31 B		0.12 A	0.11 A	0.08 b		0.11 A	0.10 A	0.08 A		0.043 A	0.042 A	0.034 B	
Second season: 2021																
Control	0.23 c	0.18 c	0.14 c	0.18 B	0.03 c	0.02 c	0.01 c	0.02 B	0.06 c	0.04 c	0.03 c	0.04 B	0.015 c	0.011 c	0.009 c	0.012 B
Tap water*	0.83 a	0.77 a	0.62 b	0.74 A	0.21 a	0.17 ab	0.13 b	0.17 A	0.22 a	0.20 A	0.15 b	0.19 A	0.073 a	0.070 a	0.055 b	0.066 A
Hot water**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean	0.53 A	0.48 A	0.38 B		0.12 A	0.10 A	0.07 B		0.14 A	0.12 A	0.09 B		0.044 A	0.041 A	0.032 B	

*** Soaking in tap water for 24 hours; ** Soaking in hot water for 24 hours.**

Means followed by the same letter in a column or row don't significantly differ according to Duncan's New Multiple Range Test at 5 % level.

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تأثير معاملات ما قبل الزراعة وإتجاه زراعة البذرة والتفاعلات بينهما على صفات إنبات بذور ونمو شتلات الماهوجني الأفريقي (*Khaya senegalensis* (Desr.) A. Juss)

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أجري هذا البحث تحت ظروف الظل بمشتل حديقة الأورمان النباتية، الجيزة، مصر، خلال موسمي ٢٠٢٠، ٢٠٢١ لدراسة تأثير معاملات ما قبل الزراعة: زراعة البذور بدون معاملة (مقارنة)، النقع في ماء الصنبور لمدة ٢٤ ساعة على درجة حرارة الغرفة والنقع في ماء ساخن (٧٠ – ٨٠ °م)، معاملات إتجاه زراعة البذرة: أفقياً لتكون فتحة النقير جانبية، أو رأسياً لتكون فتحة النقير متجهة إما إلى أعلى (upwards) أو إلى أسفل (downwards)، وكذلك التفاعلات بينهما على صفات إنبات بذور ونمو شتلات الماهوجني الأفريقي (*Khaya senegalensis* (Desr.) A. Juss) عند زراعتها في أصص بلاستيك قطرها ١٦ سم مملوءة بحوالي ١,٧ كجم مخلوط رمل وطمي بنسبة حجمية متساوية، في تجربة عاملية ذات تصميم عشوائي كامل. أوضحت النتائج أن البذور التي نقعت في الماء الساخن لمدة ٢٤ ساعة فشلت في الإنبات بكلا الموسمين، بينما تلك التي نقعت في ماء الصنبور على درجة حرارة الغرفة (٢٤ ساعة) أعطت أعلى نسبة مئوية للإنبات، أقل عدد أيام للوصول إلى أعلى نسبة إنبات (١٠٠٪) أو ٥٠٪ إنبات وكذلك أفضل متوسطات لدليل معدل الإنبات (GRI)، دليل قوة الإنبات (VI)، حيوية البذرة (SV) وطول الريشة مقارنة بالكنترول في كلا الموسمين. أيضا، فإن الزراعة الأفقية للبذرة سجلت أعلى نسبة للإنبات، أسرع إنبات، أكبر متوسطات لدليل القوة، حيوية البذرة وطول الريشة، وتلتها مباشرة معاملة الزراعة الرأسية للبذرة التي وجهت فيها فتحة النقير إلى أعلى (upwards)، حيث أعطت متوسطات قريبة من متوسطة معاملة الزراعة الأفقية في بعض الصفات. لذلك؛ فإن أفضل نتيجة على الأطلاق تم الحصول عليها من معاملة الجمع بين نقع البذور في الماء العادي (٢٤ ساعة) وزراعة البذور أفقياً. ولقد أمكن الحصول أيضاً على أتجاه مشابه فيما يتعلق بقياسات نمو الشتلات الناتجة من المعاملات التي أجريت بهذه الدراسة. طبقاً لهذه النتائج؛ يمكن التوصية بنقع بذور الماهوجني الأفريقي (*Khaya senegalensis* (Desr.) A. Juss) في ماء الصنبور لمدة ٢٤ ساعة على درجة حرارة الغرفة قبل الزراعة وزراعتها أفقياً على عمق ٢ سم من سطح التربة مع توجيه فتحة النقير جانبياً للحصول على أفضل صفات للإنبات ونمو للشتلات الناتجة.