

Effect of pretreatment on growth and early seedling performance of *Diospyros mespiliformis*.

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Abstract

An investigation was carried out to determine the effect of pre-treatment on emergence, growth and early seedling performance of *Diospyros mespiliformis*. This is a highly economic wide spread indigenous savannah species which has been recorded to grow quite slowly. The experiment consisted of eleven treatment combinations (control inclusive) replicated five times in a completely randomized design. Seed were mechanically scarified at the helium (T1) and soaked in tap water for 24 hours (T2). Four wet heat treatment; (T3-T6) seed were soaked in 60°C hot water for 3, 5, 10 and 15 minutes respectively. For the acid treatments (T7-T10) seeds were placed in concentrated hydrochloric acid (HCL) for 3, 5, 10 and 15 minutes respectively.

Pre-treated seeds were sown by their respective treatments T1-T10 with T0 representing the control in germination trays filled with sterilized river sand. At the production of 2-3 fully expanded leaves, five (5) uniform seedlings from each of the treatments were pricked into poly pots containing top soil and replicated five times in a completely randomized design.

Result shows that the treatment with seeds soaked in cold water for 24 hrs (T2) and hot water at 60°C for 3 minutes (T3) produced better seedlings with overall growth performance in terms of increment in height, collar girth and leaf production. These were closely followed by seedlings produced from seeds treated with 5 minutes concentrated hydrochloric acid (T8).

Analysis of the result further revealed that there was no significant difference in early seedling growth of *D. Mespiliformis* under the different pre-germination treatments.

Keywords: pre-treatment, *Diospyros mespiliformis*, seedling, growth performance.

1. Introduction

Diospyros mespiliformis (Africa Ebony) a savannah species from the family Ebenaceae is extremely widespread, but nearly absent in the more humid forest zones of West and Central Africa. (Keay, 1989). The wood is heavy with a density of (640–)800–900 kg/m³ at 12% moisture content. It air dries slowly, with some risks of distortion and checking. It takes about 8 weeks to air dry boards of 2.5 cm thick from 60% to 12% moisture content. The heartwood is durable, being resistant to termite attack.

In West Africa trees usually flower in the second part of the dry season, but elsewhere flowering usually takes place in the rainy season (Albrecht, 1993). In Nigeria flowers are most common in October–November. Fruits ripen about 6 months later. *Diospyros mespiliformis* is usually propagated by seeds. Fruits should be collected from the tree when they start to become yellow.

Diospyros mespiliformis grows quite slowly (Coates, 2002). Previous research revealed that seedlings of this plant reach about 10 cm tall 2.5 months after germination and 20–30 cm height after 6 months, while young trees often attain only 1–1.5 m height after 5 years (Osei- Begyina, 2007) compared with some other timber species which are faster growing. For instance, Mac Gregor (1934) observed that *Terminalia ivorensis* could grow up to 1.8m in height in one year, While *Cordia allidora*, has an annual girth increment of about 1.34cm-2.63cm (Hazlett, 1989).

This study therefore intends to evaluate the growth response of *Diospyros mespiliformis* to different pre-germination treatments in order to determine the most suitable pre-treatment method that could facilitate the growth and development of the seedlings.

Materials And Methods

The study Location

Seeds of *Diospyros mespiliformis* were freshly harvested from mother trees within Olokemeji forest reserve (a woodland savanna enclave) in Ogun State. Seeds used for this trial were thoroughly mixed together and randomly selected. The seeds were subjected to eleven pre-treatments which consisted of mechanical scarification, 4 acid and 5 water treatments, varying soaking time duration and temperature regimes respectively, and then the control.

The treatments were made up of seeds mechanically scarified at the helium (T1) to allow the seeds to easily imbibe water. (T2) consisted seeds soaked in tap water for 24 hours and thoroughly rinsed before sowing. For the wet heat treatment, (T3-T6) seeds were placed in 60^oc hot water for 3,5 10 and 15minutes respectively. Acid treatments (T7-T10) were carried out by placing the seeds in concentrated hydrochloric acid for 3,5,10 and 15 minutes respectively. The acid was later decanted, the seeds removed and thoroughly rinsed with tap water.

Eleven germination trays were filled with sterilized river sand and seeds sown in them according to their treatments with T0 representing the control. The seeds were left to germinate and seedling emerged After emergence, seedling were allowed to produced 2-3 fully expanded leaves then 5 uniform growing seedlings were selected from each of the treatments and pricked into polypots containing top soil and replicated five times in a completely randomized design to give a total of 25 seedlings per treatment unit.

The seedlings were left to stabilize for another two weeks to allow an upsurge in their shoot growth and growth of other morphological parameters (Igboanugo, 1990). Growth parameters such as seedling height, collar girth, and leaf production were accessed on each seedling fortnightly for 12 weeks after transplanting. The data collected were subjected to analysis of variance (ANOVA), and then the means were separated using Duncan multiple range test (DMRT).

Results And Discussion

Collar girth

Table 1: Mean collar girth (cm) of *Diospyros mespiliformis* seedlings 12 weeks after planting (WAP).

Treatment/Weeks after planting	2	4	6	8	10	12
C(T0)	1.52	1.74	1.77	1.95	2.25ab	2.92
MS(T1)	1.68	1.84	2.08	2.21	2.65bc	2.83
W24Hrs(T2)	1.72	2	2.26	2.36	2.93c	3.16
W3mins(T3)	1.51	1.79	2.07	2.15	2.57abc	2.67
W5mins(T4)	1.72	1.88	2.01	2.1	2.37ab	2.56
W10mins(T5)	1.59	1.63	1.95	2.02	2.47abc	2.95
W15mins(T6)	1.61	1.75	2.03	2.08	2.26ab	2.56
HCL3mins(T7)	1.56	1.8	1.99	2.11	2.5abc	2.88
HCL5mins(T8)	1.64	1.78	2.05	2.13	2.22ab	2.52
HCL10mins(T9)	1.49	1.74	1.84	1.93	2.14a	2.81
HCL15mins(10)	1.54	1.61	1.73	1.88	2.18ab	2.6
SEM	0.02	0.02	0.03	0.03	0.05	0.04
p-value	0.666ns	0.078ns	0.173ns	0.215ns	0.03*	0.066ns

*=significant (p<0.05)

ns=not significant (p>0.05)

The results of mean values of collar girth increment are presented in Table 1, T2-seed soaked in tap water for 24hrs had the highest collar girth increment of 3.16 cm followed by T5-seeds soaked in 60°C hot water for 10 minutes with 2.95cm while the control T0 was 2.92cm respectively, and the least value of 2.52cm was observed in T8-seed soaked in conc. HCL for 5 minutes. It was also observed that there was a steady increase in collar girth increment in all the treatment over the study period. Table 1 also revealed that while there was no significant difference in collar girth increment ($p < 0.05$) between the treatments, the interaction between treatment across the time interval (weeks of planting) were highly significant.

Height

Table 2: Mean shoot height (cm) of *Diospyros mespiliformis* seedlings 12 WAP

Treatment/Weeks after planting	2	4	6	8	10	12
C(T0)	5.17a	6.06a	7.84abc	8.34ab	8.98	10.9
MS(T1)	6.06abc	6.12a	7.35ab	7.84a	8.3	9.91
W24Hrs(T2)	6.77c	7.27b	8.84c	9.52c	9.94	11.63
W3mins(T3)	6.49bc	6.86ab	8.46bc	9.17bc	9.88	12.08
W5mins(T4)	5.73abc	6.42ab	8.09abc	9.24bc	9.4	10
W10mins(T5)	6.10abc	6.46ab	8.10abc	8.77abc	8.87	10
W15mins(T6)	5.56ab	6.23a	8.24bc	8.53abc	9.68	11.66
HCL3mins(T7)	6.11abc	6.56ab	7.10a	7.99a	8.9	10.33
HCL5mins(T8)	6.46bc	6.93ab	8.94c	9.24bc	9.66	12.83
HCL10mins(T9)	6.28abc	6.47ab	7.89abc	8.88abc	9.3	11.38
HCL15mins(T10)	5.64bc	6.36ab	8.24bc	8.54abc	8.87	10.2
SEM	0.11	0.09	0.12	0.12	0.12	0.23
p-value	0.102ns	0.17ns	0.024*	0.031*	0.052ns	0.070ns

*=significant ($p < 0.05$)

ns=not significant ($p > 0.05$)

Height

The results of the mean values of shoot height increment of *Diospyros mespiliformis* seedlings (Table 2) shows that all the treatments observed a regular increase in shoot height throughout the assessment period. T8 had the highest mean value 12.83cm while the least value of 9.91cm was recorded for T2. The result of analysis of variance revealed no significant difference ($p < 0.05$) between the treatments from the first four weeks and the last four weeks of data collection. However, the interactions between treatment and age of seedlings were significant.

Leaf Production

Table 3: Mean leaf production of *Diospyros mespiliformis* after 12 WAP

Leaf Number

Treatment/Weeks after planting	2	4	6	8	10	12
C(T0)	2.2ab	3.2bc	5.4	6.2abcd	7.8	9.4
MS(T1)	2.1ab	3.4c	5.3	6.9cd	7.8	9.7
W24Hrs(T2)	3.0c	3.2bc	5.4	7.0d	8.7	9.7
W3mins(T3)	2.4b	3.2bc	5.5	6.7bcd	8.8	10
W5mins(T4)	2.0ab	2.5ab	4.8	5.8ab	7.3	8.3
W10mins(T5)	1.9a	3.2bc	5.2	5.9abc	7.3	9
W15mins(T6)	2.0ab	2.6ab	4.3	5.8ab	8	9
HCL3mins(T7)	2.0ab	3.0abc	4.8	5.5a	7.6	8.6
HCL5mins(T8)	2.0ab	3.5c	5.8	6.3abcd	8.6	11
HCL10mins(T9)	2.0ab	3.1bc	5.2	6.4abcd	7.5	9.1
HCL15mins(T10)	2.0ab	2.4a	4.7	5.8ab	7.6	8.3
SEM	0.06	0.08	0.1	0.11	0.16	0.2
p-value	0.001*	0.010*	0.067ns	0.024*	0.439ns	0.116ns

*=significant (p<0.05)

Ns=not significant (p>0.05)

The mean values of leaf production are presented in Table 3. T3- 3mins water treatment had the highest leaf count of 10.00 followed by T1 and T2 with the same mean values of 9.70 respectively. T4 and T10 had the least values of 8.3 of all the treatments investigated. The leaf counts between the treatments were significant at the 2nd, 4th and 8th weeks after planting.

However, no significant difference was observed between the treatment at the 6th, 10, and 12th weeks of the experiment. The interaction between the treatments and plant age were also found to be significant.

Table 4: Final mean values of growth parameters of *Diospyros mespiliformis* under different treatments 12WAP

Treatment	Collar diam	Height	Leaf number
C(T0)	2.92	10.90	9.40
MS(T1)	2.83	9.91	9.70
W24Hrs(T2)	3.16	11.63	9.70
W3mins(T3)	2.67	12.08	10.00
W5mins(T4)	2.56	10.00	8.30
W10mins(T5)	2.95	10.00	9.00
W15mins(T6)	2.56	11.66	9.00
HCL3mins(T7)	2.88	10.33	8.60
HCL5mins(T8)	2.52	12.83	11.00
HCL10mins(T9)	2.81	11.83	9.10
HCL15mins(T10)	2.60	10.20	8.30

Conclusion

It can be concluded that *Diospyros mespiliformis* will grow and perform fairly well at seedling stage without pre-treatment (Table 4). However for enhanced early seedling performance, water treatment, seeds soaked for 24 hrs

(T2) and wet heat treatment,(T3) where seeds were soaked in 60⁰c hot water for 3min are recommended as these two treatments produced the best seedlings in terms of overall growth performance, in shoot height, collar girth and leaf production in this study. However, where there is access to acid T8 (seed treated for 5mins in conc. HCL) is recommended.

References

Albrecht J.E.D.(1993).Tree seed hand book of Kenya.GTZ forestry seed Center Muguga, Nairobi, Kenya.

Hazlett, D.L (1989): Provenance age and defoliation effects on the growth of *cordial alliodora* in Central America. Forest ecology and Management,42: 191-202.

Keay, R.W.J. (1989) Trees of Nigeria. A revised version of Nigerian trees (1960, 1964) by Keay, R.W.J., Onochie, C.F.A. & Stanfield, D.P. Clarendon Press, Oxford, United Kingdom. 476 pp.

Igboanugo, A.B.I(1990):Adaptations of shoot growth and leaf production of laboratory-growth cuttings of *triplochiton scleroxylon* K.Schum. in response to changes in irradiance. Forest Ecology and Management 43(1-2) 135-142.

MacGregor, W.D (1934): Silviculture of the mixed deciduous forest in Nigeria. Oxford Forest Memo 18:64-67.

Osei-Begyina, A.,(2007).Effect of inorganic (NPK) fertilizer on the growth rate of one-year old *Diospyros mespiliformis*. B.Sc. Natural Resources Management thesis, Department of Silviculture and Forest Management, Faculty of Renewable Natural Resources, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. 40 p

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