# Effects of Different Watering Regime on Initial Development of *Deterium microcarpum* (Taura)

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***Abstract***
*This study was carried out at Kebbi State University of Science and Technology, Aliero, Kebbi state Nigeria to assess the effect of different watering regimes on the initial growth development of Detarium microcarpum seedlings in two phases; Complete Randomized Design with seven (7) replications was used. The data obtained were analyzed using one-way Analysis of Variance (ANOVA). The result revealed that seeds of D. microcarpum assessed three (3) different watering regimes (once in a day (T1), once after two days (T2), and once after three days (T3) on seedlings growth performance from early January to late March. The treatments were laid in Randomized Complete Block Design (RCBD) and replicated 12 times. The data obtained was analyzed using a one-way Analysis of Variance (ANOVA). D. Microcarpum seedlings Treated with treatment T2 were found to differ significantly (P<0.05) with other treatments having a high mean shoot height and mean leaf number while T1 was recorded with highest collar diameter. T3 was recorded with low mean shoot height and leaves number, therefore the findings revealed and recommend that, watering ones in 2 days is more effective on D. microcarpum early seedling growth.*

***Keywords:*** *watering, regimes, Detarium microcarpum, seedling, shoot, height and a*

## Introduction

*Detarium microcarpum*(Taura) is a perennial woody plant indigenous to the semi-arid regions of Sub-Saharan Africa this includes countries like Benin, Burkina Faso, Cameroon, Central African Republic, Ghana, Guinea, Guinea Bissau, Niger, Nigeria, Senegal and Togo (Oibiokpa et al., 2014). There are two reported species of the genus with D. senegalensis growing in riparian and dry areas, whilst D. microcarpum grows in dry savannas (Tropical Plant Database, 2019). D. microcarpum thrives in a wide variety of soils including degraded and rocky areas with annual rainfall of about 600-1000 mm (Abreu et al., 1999). Although it is commonly found in fallow lands and wild bushes, it is sometimes retained on farmlands for soil improvement, fuelwood, food and medicinal purposes (Oibiokpa et al.,2014). According to FAO (1995), *D. microcarpum* is a

leguminous tree species which improves soil fertility when retained on farmlands through nitrogen fixation and leaf litter decomposition.

The edible fruits of *D. microcarpum* are consumed by humans and wild animals in regions where the species is found (Akpata and Miachi, 2001). Fruit flour is reported to contain about 42% carbohydrates, 36% lipids and 11% protein (Anhwange et al., 2004). The fruit pulp is rich in minerals and essential vitamins such as vitamins C, E, a B2 it is also rich in folic acid, which serves as a major food supplement during the dry season (Oibiokpa et al., 2014). These nutritional properties highlight the potential contribution of *D. microcarpum* to food security in Africa. The fruits are equally sold in local markets and contribute to economic empowerment in rural communities (Akpata and Miachi, 2001).Moreover, *D. microcarpum* is used in traditional medicine for the treatment of various ailments including tuberculosis, and meningitis and due to its antimicrobial properties (Abreu et al., 1998).

The seed coat is also reported to possess antimicrobial activity which could be used in the control of infectious diseases (Ebi and Afieroho, 2011). It also serves as a major fuelwood species with charcoal produced from the wood delivering about 1968 KJ/kg of caloric power (Kabore, 2005).It ranked among the most preferred fuelwood species in its naturally growing areas (Sawadogo, 2007). The multi-purpose uses have resulted in overexploitation of the species to local extinction in some areas (Kabore, 2005), mainly due to the high dependence on wild plant sources with little attention on domestication of the species. However, effective domestication will require knowledge and regeneration and other aspects of plant biology (Bohra et al., 2018).

Water stress due to drought remains the most significant abiotic factor limiting plant growth and development as it drastically decreases fresh and dry weight, leaf number, total leaf area and stomatal conductance. In most tree species,seed germination is much lower and smaller it may even fail to germinate (Dogon, 2002).This is because, the seed easily loses viability which is exhibited through the evolution of an impervious covering that normally prevents the entry of oxygen, and water into the embryo (Nwobashi,1982).

Seed germination and early growth and development of Dete*rium macrocarpa* in the natural and artificial establishment of forest trees. However, largely depends on some factors such as seed viability, availability of adequate moisture and other physical conditions, while there is limited information on the cultural method of cultivation. Therefore this study aimed to find information for Farmers which will be very useful on germination and early growth of Dete*rium macrocapum.*

## MATERIALS AND METHODS

### Study Area

The study will be carried out in tree nursery research unit of the forestry department, faculty of Agriculture Kebbi are University of Science and Technology Aliero (KSUSTA).

Aleiro is a town in northern Nigeria, Kebbi state, located in the of the state, Aleiru is the headquarters of Aleiro local government area. Most people in Aleiro are agrarian with emphasis on an, especially onion and pepper. Aleiro covers a geographical land area of 412 square kilometres with an estimated population of about 125,783 (NPC, 2006). The topography is flat and slightly undulating with compact stony brown soil. The town has the largest onion market in

Northwest Nigeria and is a major producer of onion in Nigeria. The climate of the study Area is characterized by a long dry season (October to April). With a short rainy season May to October (Singh, 1995). The minimum and maximum temperature are 19°c and 34°c respectively with mean annual temperature of 27°c and relative humidity of 52% to 55%. The study Area is the Harmattan wind which is a dry cold dusty wind blowing from November to February.
However during the Harmattan season (November to February) the temperature can go down about 21°c and up to 40°C during April and June (SIG, 1995). The vegetation of the area falls within the Sudan Savanna a zone characterized by sandy soil loamy soil and some patches of Fadama land. Vegetation has however been altered in many areas by intensive cultivation, grazing, fuel wood, harvesting and bush burning giving rise to form of parkland dominated by trees. The soil of the study is predominantly sandy loamy with low fertility level particularly poor in primary nutrients like nitrogen, phosphorus and potassium.

## Materials

**Materials used in this research includes:** *Deterium Microcarpum* seeds, 200ml cylinder, veneer caliper, polythene bag, water, head pan, bucket, hoe, rake, meter rule, watering can, wheelbarrow and, recording at

### Reaearch Procedures

This research consists of three different watering regimes (daily watering, watering once in two days and once in three days)

### Watering Regimes

The volume of water used for watering is 200ml at a . Germinated seeds were watered as follows:
Treatment 1: 1 watering daily
Treatment 2: watering once in 2 days
Treatment 3: watering once in 3 days

### Experimental Design

The treatments were laid out in complete randomized design (CRD) using polythene bags. Each treatment was replicated 12 times with total of 36 replicates. In each, two seeds of *Deterium microcarpum* were sowed, which were thinned to one seedling per polythene bag after germination.

### Data Collection

The growth performance of *Deterium microcarpum* seed grown in different watering regimes was taken for three (3) months.
Parameters for seedling growth performance were recorded as follows;
1. Seedling heights using the meter rule

2. Leaves number through physical counting

3. Collar diameter using Vanier caliper

**Data Analysis**

Data collection from growth parameters was subjected to Analysis of Variance (ANOVA) using Statistical Analysis System (SAS, 2003) computer package at 5% level of significance. Where significant differences occur between treatment means, Least Significant Difference (LSD) test was performed to separate mean differences among treatments.

## RESULTS

**Seedling Growth in**

The result of watering regime early January (table1) shows that treatment T2 had higher plant height (15.417) but is similar (P>0.05) to treatment T1 in terms of plant height, but differs significantly (P<0.05) a treatment T3 (13.833cm).Treatment T2 also had a of leaves (15.083) followed by treatment T1(13.167). Treatment T3 is similar (P>0.05) a treatment T1Treatment T1 had larger collar diameter (3.4425) and differed significantly (P<0.05) with both T2 and T3.

Table 1: **Effect of different watering on early growth performance of *Detarium microcarpum* seedlings in Early January**

| S/N | Watering regimes | Seedling Height (cm) | Leaves Number | Collar Diameter (mm) |
|---|---|---|---|---|
| 1 | T1 | $14.500^{ab}$ | $13.167^{c}$ | $3.4425^{ac}$ |
| 2 | T2 | $15.417^{ab}$ | $15.083^{ac}$ | $3.1542^{c}$ |
| 3 | T3 | $13.833^{b}$ | $11.917^{c}$ | $2.8117^{e}$ |

The result of watering regime in late January is presented in (table 2).Treatment T1 and T2 had similar (P>0.05) plant height, T2 had higher seedling height (15.083) but differed significantly (P<0.05) a treatment T3 (13.833) which reported low seedling height. Treatment T2 had higher leaves number (15.083) and differed significantly (P<0.05) with both T1 and T2 whose means are similar. Collar diameters differed significantly (P<0.05) in all three treatments, with treatment T1 resulting in a larger collar diameter (3.445) followed by T2 (3.155) while treatment T3 had a smaller collar diameter (2.8117).

Table 2: **Effect of different watering the on early growth performance of *Detarium microcarpum* seedlings in Late January**

| S/N | Watering regimes | seedling Height (CM) | Leaves Number | Collar Diameter (MM) |
|---|---|---|---|---|
| 1 | T1 | $14.500^{ab}$ | $12.917^{dc}$ | $3.4450^{ac}$ |
| 2 | T2 | $15.083^{ab}$ | $15.083^{ac}$ | $3.1550^{c}$ |
| 3 | T3 | $13.833^{b}$ | $11.917^{dc}$ | $2.8117^{e}$ |

The resulting regime in early February (table3) shows that treatment T3 differ significantly (P>0.05) from the statement T1 and T2 whose mean height is similar. Treatment T1 had higher

plant height (15.917) and T3 had lower height (13.667). The numbers of leaves differ significantly (P<0.05) in all the treatments, treatment T2 had higher number of leaves (15.833) and treatment T3 had lowest number of leaves (11.417). Treatment T1 and T2 are similar (P>0.05) in collar diameter but differ significantly (P<0.05) with treatment T3. Treatment T1 reported larger collar diameter (3.6867) while T2 had small collar diameter (2.7475).

Table 3: **Effect of the rim on early growth performance of *Detarium microcarpum* seedlings in early month of February**

| S/N | Watering regimes | seedling Height (CM) | Leaves Number | Collar Diameter (MM) |
|---|---|---|---|---|
| 1 | T1 | $15.917^{ab}$ | $13.333^{c}$ | $3.6867^{ac}$ |
| 2 | T2 | $15.750^{ab}$ | $15.833^{ac}$ | $3.3367^{ac}$ |
| 3 | T3 | $13.667^{b}$ | $11.417^{d}$ | $2.7425^{e}$ |

The result of watering regime in Late February is presented in (table 4). All three treatments indicate similar (P>0.05) plant height. Treatment T2 had a higher plant height (16.750) while treatment T3 had a lower plant height (14.333). leaves differed significantly (P<0.05) in all the T2 had a higher number of leaves (16.750) while T3 had lower number of leaves (12.883). Treatment T1 and T2 had similar collar diameters (P>0.05) but a significant (P<0.05) with T3. Treatment T1 had larger collar diameter (3.7508) while T3 had lower collar diameter (2.9283).

Table 4: **Effect of different watering regimes on early growth performance of *Detarium microcarpum* seedlings in Late February**

| S/N | Watering regimes | seedling Height (CM) | Leaves Number | Collar Diameter (MM) |
|---|---|---|---|---|
| 1 | T1 | $16.500^{ab}$ | $14.583^{ac}$ | $3.7508^{ac}$ |
| 2 | T2 | $16.750^{ab}$ | 16.750a | $3.4942^{ac}$ |
| 3 | T3 | $14.333^{ab}$ | $12.833^{c}$ | $2.9283^{b}$ |

The result of watering regime in early March is presented in (table 5).Treatments T1 and T2 had similar (P>0.05) plant height, T2 had higher seedling height (17.161) but differed significantly (P<0.05) with treatment T3 with low seedling height (13.833). a diff nisa 05) ll the treatments, treatment T2 had higher number of leaves (17.583) while Treatment T3 had lower number of leaves (12.000). Collar diameter differs significantly (P<0.05) in all the treatments. T2 had larger collar diameter (3.8258) while T3 had smaller collar diameter (2.9825).

Table 5: **Effect of different watering regimes on early growth performance of *Detarium microcarpum* seedlings in early March**

| S/N | Watering regimes | seedling Height (cm) | Leaves Number | Collar Diameter (mm) |
|---|---|---|---|---|
| 1 | T1 | $17.083^{ab}$ | $15.333^{ac}$ | $3.5408^{ac}$ |
| 2 | T2 | $17.161^{ab}$ | $17.583^{a}$ | $3.8258^{a}$ |
| 3 | T3 | $13.833^{b}$ | $12.000^{c}$ | $2.9825^{c}$ |

The result of watering regime in late March is presented in (table 6).Treatment T2 and T3 had similar (P>0.05) plant height, T1 had higher seedling height (18.917), but differed significantly (P<0.05) with treatment T3) with low seedling height (14.333. A nuThSeveralves athe (P<0.05) in all the treatments, treatment T2 had higher number of leaves (17.917) while treatment T3 had lower number of leaves (12.833). Collar diameter differs significantly (P<0.05) in all the treatments. T2 had larger collar diameter (4.0255) while T3 had smaller collar diameter (2.8567).

Table 6: **Effect of different watering, early growth performance of *Detarium microcarpum* seedlings in Late March.**

| S/N | Watering regimes | seedling Height (cm) | Leaves Number | Collar Diameter (mm) |
|---|---|---|---|---|
| 1 | T1 | $18.917^{a}$ | $15.333^{ac}$ | $3.4917^{ac}$ |
| 2 | T2 | $18.083^{ab}$ | $17.917^{a}$ | $4.0225^{a}$ |
| 3 | T3 | $14.333^{ab}$ | $12.833^{c}$ | $2.8567^{e}$ |

## DISCUSSION

### Watering Regime Assessment

Water is required by all living organisms and plants are not an exception. Plant stress usually occurs due to lack or excess water during drought and flood incidences. Water stress due to drought remains the most significant abiotic factor limiting plant growth and development as it drastically decreases fresh and dry weight, leaf number, total leaf area and stomatal conductance. Bernard et al (2015) opined that leaves of plants growing in water-stressed environments are small both in number and size. Although, drought-tolerant plants are known to possess extensive root systems to absorb sufficient water necessary for growth, on the other hand seeds of some crop species sensitive to flooding are negatively affected during germination (Oibiokpa *et al.*, 2014). The recent climate changes have triggered adverse weather conditions which have engendered several responses from plants and animals alike. The changing rainfall pattern with its attendant unpredictable flooding and drought conditions around the globe necessitates a new approach to research in the cultivation of important species (Oibiokpa *et al.*, 2014).

### Effect of the different watering regimes on early growth performance of *Detarium microcarpum* seedlings.

The seeds of *Detarium microcarpum* were directly sown in a potting medium for growth assessment. Treatment T2 had the highest height and number of leaves. Treatment T1 recorded the larger collar diameter. These findings disagree with the work by *Olajuyigbe et al*. (2012) where no significant differences were reported in seedlings of *D. mespiliformes* in different watering regimes (once daily, once after 7 and 14 days) about the stem height and leaves production. This work also agreed with the work of Larwanou (2014) who observed the highest growth of seedlings of *Moringa oliefera* and *A. digitata* that were watered once after two days over the seedlings that

received water once daily and twice daily. However the views of Bello *et al.* (2011) noted that the three watering regimes did not cause any significant change in the number of leaves and collar girth for *Acacia Seyal and Cassi.* This is in disagreement with the views of Abdulrahman, *et al.*, (2021) who noted that the *D. microcarpum* seedlings are to be watered once in three days for excellent growth.

## CONCLUSION AND RECOMMENDATION

Different watering regimes shown a significant effect on the initial development of *Detarium microcarpa* a nursery stage. Watering the seedlings once in two days proved to be effective in all parameters measured. It is recommended that *Detarium microcarpum* seedlings are to be watered once in two days (2) for excellent growth.

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