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Effect of Water Regime on Plumule Emergence and Early Seedling Growth of Monodora Myristica

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Abstract

The study was carried out to investigate the effect of watering regime on the germination and early seedling development of *Monodora myristica*. 150 seeds of *Monodora myristica* were selected, divided into five groups and sown separately in top soil filled into plastic germination pots. They were subjected to five watering regimes, viz: watering once weekly with 100mls (T_1), watering twice weekly with 100mls (T_2), watering once weekly with 200ml (T_3), watering twice weekly with 200ml (T_4) and watered with 100ml only on the first day of planting (control, T_5). Each treatment was replicated three times and data obtained for four months. Growth parameters assessed were percentage germination, coefficient of velocity, plant height, stem girth, leaf production per seedling and leaf area. The data obtained were subjected to percentages and Analysis of Variance (ANOVA). The means were separated by Least Significant Difference (LSD; $p \leq 0.05$). Results obtained showed that seeds that received 200mls water twice a week (T_4) had the highest mean germination (70%), plant height, stem girth and leaf area. Leaf production was highest in seedlings watered 100mls twice weekly (T_3). Seedlings watered with 100ml once weekly recorded the least performance in all growth parameters and there was no growth in the control.

Keywords: Water; Germination; Growth; *Monodora myristica*.

1. Introduction

Good productivity of plant species depend mainly on the availability and efficient use of water resources. Nutrients are drawn from the soil and used by the plants. Water helps a plant by transporting important nutrients through the plants. If there is not enough water for the plant, the nutrients it needs cannot travel through the plant. Water is an important factor in the growth, development and productivity of plants [1].

Growth reductions in plants are one of the first manifestations of water deficit [2]. Hartmann and Kester [3], asserted that water limits plant growth in all environments. Water stress due to drought is the most significant abiotic factor limiting plant growth and development [4]. It drastically decrease fresh and dry weights, leaf number and total leaf area and stomata conductance [5]. During vegetative growth, phyllochron decreases under water stress [6] and leaves become smaller, which result in low leaf index, as well as low shoot dry weight [7].

Plant species respond differently to water availability, also different plant parts adapt differently to varying water stress condition. Under water deficiency, growth is readily inhibited and growth of roots is favoured over that of leaves [8]. Hoogenboom, *et al.* [9], reported that roots play an important role in plant survival during periods of drought. Drought-tolerant plants are known to posses extensive root systems so as to absorb sufficient water necessary for growth.

Study by Sale [10], revealed that different criteria, based on soil, plant and metrological factors, are used for the estimation of crop water needs. Isiah, *et al.* [11], observed that water in excess of plant needs may also retard physiological processes in plants. Water availability in adequate quantity and at biologically tolerable interval affects physiological activities of plants. Scheduling water application is very critical to produce high crop yield as excessive irrigation reduces yield while inadequate irrigation causes water stress and reduces production [12]. Hence the proper balance of water is important when growing plants.

This study being reported here aimed to investigate the most appropriate watering regime to enhance early seedling growth of *Monodora myristica* in the nursery.

2. Materials and Methods

M. myristica seeds were extracted from pods and air-dried under room conditions. 50 seeds of were selected and divided into five groups, each made up of 30 seeds. In each group, ten seeds were sown separately in top soil filled into plastic germination pots. Each group were subjected to five watering regimes and the treatments labelled as follow:

T_1 for pot treated once weekly with 100ml of water,

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T_2 for pot treated twice weekly with 100ml of water,
T_3 for pot treated once weekly with 200ml of water,
T_4 for pot treated twice weekly with 200ml of water and,
T_5 for pot treated with 200ml of water only on the first day of planting and used as Control.

Each treatment above was replicated three times and the pots arranged in Completely Randomized Design (CRD). Seedling emergence was observed from the first day and continued for two weeks and recorded.

The % seedling emergence was calculated as:

$$\% \text{ Emergence} = \frac{\text{No. of seedlings that emerged}}{\text{No. of seeds planted}} \times 100$$

Also, the coefficient of velocity was calculated as:

$$\text{CoV} = \frac{A_1 + A_2 + A_3 + \ldots\ldots\ldots\ldots A_n}{A_1T_1 + A_2T_2 + A_3T_3 + \ldots\ldots\ldots A_nT_n}$$

Where A is the number of seedlings that emerged on a particular number of days,
T is the number of days involved

The resulting seedlings were maintained and growth assessment was carried out after 4 weeks of emergence, for four months. Parameters assessed were plant height, leaf production per seedling, stem girth and leaf area. Data obtained were subjected to analysis of variance (ANOVA) and least significant difference (LSD) at 5% probability level was used to compare the means.

3. Results and Discussion

Table 1 shows the effect of varying watering regimes on germination percentage and coefficient of velocity of *Monodora myristica*. Treatment T_4 had the highest mean germination (70%), followed by T_2, (63%). There was no germination in the control (T_5). While the highest coefficient of velocity emerged was observed in T_2 (8.57), followed by T_4 (7.38).

Table-1. Effect of varying watering regime on percentage seedling emergence and coefficient of velocity of *M. myristica*

Treatments	Germination percentage (%)	Coefficient of velocity
T_1	50	6.43
T_2	63	8.57
T_3	57	4.20
T_4	70	7.38
T_5	0	0

Table-2. Effect of varying watering regime on plant height (cm) of *M. myristica*

Treatments	Plant Heights (cm) / Month			
	1	2	3	4
T_1	7.73a	8.69a	10.62a	11.96a
T_2	8.18b	9.53b	11.73b	13.05c
T_3	8.05b	9.52b	11.65b	12.70b
T_4	8.19b	9.93b	12.62c	14.05d
T_5	0	0	0	0

Table-3. Effect of varying watering regime on stem girth (mm) of *M. myristica*

Treatments	Stem girth (mm) / Month			
	1	2	3	4
T_1	1.88a	1.93a	1.97a	2.01a
T_2	2.02b	2.09b	2.16b	2.22b
T_3	2.03b	2.11b	2.17b	2.26b
T_4	2.02b	2.13b	2.24b	2.37b
T_5	0	0	0	0

The effect of varying watering regime on plant height is shown in Table 2. The results revealed that the heights of the various treatments with the exemption of T_1 were not significantly different ($p \leq 0.05$) in the 1st and 2nd but significant differences abound in the 3rd and 4th months, with exemption in the heights of T_2 and T_3 in the 3rd month that were not significantly different from each other. However, at month 4, T_4 seedlings gave the highest plant height of 14.05cm, followed closely by T_2 (13.05cm). The least value of 11.96 was obtained in T_1 seedlings.

The effect of watering regime on stem girth is presented in Table 3. The highest stem girth (2.37mm) was recorded in T_4 seedlings and the least in T_1 seedlings (1.88mm). Table 4 shows the effect of the watering regime on the number of leaves. At the 4th month, seedlings watered with 100mls twice weekly (T_2) had the highest (6.00) number of leaves. The result of the effect of the watering regime on leaf area is shown in Table 5. Treatment T_4 had the highest leaf area at the 1st and 4th months of the experiment.

Table-4. Effect of varying watering regime on number of leaves of *M. myristica*

Treatments	Number of Leaves / Month			
	1	2	3	4
T_1	4.22a	4.67a	5.00a	5.22a
T_2	4.44a	5.11b	5.56b	6.00c
T_3	4.33a	4.77a	5.11a	5.33a
T_4	4.33a	4.78a	5.33ab	5.56b
T_5	0	0	0	0

Table-5. Effect of varying watering regime on leaf area (cm^2) of *M. myristica*

Treatment	Leaf area (cm^2) / Month			
	1	2	3	4
T_1	11.21a	16.32a	18.86a	21.10a
T_2	12.90b	18.50b	24.42c	29.32c
T_3	13.45c	18.31b	22.62b	25.17b
T_4	16.16d	22.63c	30.70d	37.44d
T_5	0	0	0	0

Previous study by Anurachalam, *et al.* [13] revealed that moisture and aeration play key roles in germination of seeds as they enhance metabolic activities in the seeds. The lack of germination in T_5, the control experiment in this study, lends credence to the above assertion. The seeds watered with 200ml/twice weekly had the highest germination rate when compared to others. This further stressed the significance of water in the germination of seeds of this species. Study by Awodola [14] opined that reduction in relative water contents affects physiological processes and hence plant growth. This is confirmed in this study when seedlings watered with 100ml once weekly recorded the least plant height.

Results from other growth parameters considered in the study also revealed that seedling girths, number of leaves and leaf area recorded higher values when treated with adequate amounts of water. T_4 (i.e. seedlings treated with 200mls/twice weekly) had the highest girth and leaf area. T_2 (i.e. seedlings treated with 100mls/twice weekly) had the highest number of leaves. Previous study by Dauda, *et al.* [15] asserted that the leaf number of Myrobian seedlings was significantly affected by watering frequency. Other studies, such as those of Blum and Johnson [16]; Huang and Redmann [17], and Kefu, *et al.* [18] supported this view. In fact, Lawlor and Leach [19] asserted that decrease in leaf area is a common effect of poor supply of water.

In conclusion, the results obtained from this study revealed that *M. myristica* requires adequate supply of water for proper growth and production of seedlings for successful domestication of this species in the country.

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