



An Assessment of Environmental Requirements for Tamarind Seeds Germination in Agriculture Education Department Farm, Federal University of Education, Zaria

Abubakar Bayero, Timothy Yusuf
Department of Agriculture Education,
Federal University of Education Zaria, Kaduna State

ABSTRACT

In order to achieve the objectives of the research, relevant materials were dully consulted in respect of tamarind propagation by seeds from different sources. The synthesize ideas in respect of procedures for tamarind propagation by seed were strictly observed at the first, second, third and fourth experimental trials conducted in the months of October, November, December and January. The research concludes that among other requirements like seed treatment, loamy soil, and watering regime, temperature constitute a very vital influencing factor in tamarind seed germination after the fourth trial in the month of January in which seeds germination was also observed. The research therefore concludes that since tamarind seeds germination is very sensitive to low temperature, it is advisable that seed propagation practices should be carried out between the month of December to January when environmental temperature is very low in the study area typical of Northern Guinea savannah climatic Zone of Nigeria.

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INTRODUCTION

Tamarind (*Tamarindus indica*), been a member of the Leguminosae (Fabaceae) family, is a tropical tree native to Africa and widely cultivated in India, Southeast Asia, and various parts of tropical America (Bansal, 2022). The fruit pulp is rich in tartaric acid, sugars, and minerals like calcium and magnesium, making it valuable not only as a food but also as a functional ingredient in various medicinal formulations (Ghamood, 2021).

In Nigeria, tamarind's economic and cultural significance is pronounced, serving as food, medicine, and a source of income for many rural communities. The use of tamarind in local cuisines and its incorporation into traditional remedies highlight its importance (Bamgbose, 2023). Despite these attributes, the cultivation of tamarind is also constrained by challenges related to seed germination and seedling establishment due to the fact that the seed often display dormancy, necessitating specific environmental

conditions to facilitate their germination and growth (Sultana.,2020, Kumar., 2022).

Previous research has established that tamarind seeds exhibit seed dormancy, and may require specific conditions to break the dormancy to enabled germination takes place (Uma Shaanker., 2017). Hence, without proper understanding of the ecological and environmental needs for tamarind seeds optimal germination and growth, many farmers are now lacking the successful propagation techniques of this economically valuable tree (Prakash., 2022, lyalogu., 2023)

In Kaduna state, tamarind pulp is very expensive across the state most especially during the month of Ramadan, costing as high as Two Hundred and fifty thousand naira per 100kg bag in the market due to high demand. The high cost of tamarind pulp in the market experienced around Zaria area is owing to the fact that tamarind is not produce in the area like mango, guava, oranges or cashew nuts due to the sensitive environmental

Corresponding author: Abubakar Bayero

✉ monyayevillabe50@gmail.com

Department of Agriculture Education, Federal University of Education Zaria, Kaduna State.

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conditions required for the germination of tamarind seeds (KADA, 2023). The existing situation has stimulated the department of agriculture of the university to study the environmental conditions for tamarind seed propagation and management. Thus, Understanding the environmental requirements, such as temperature, soil type, and moisture levels, for the successful propagation of tamarind by seed in the area of study can lead to improved agricultural practices that will enhance tamarind production, soil organic matter management and income stability of the farmers who are going to pick interest in tamarind production under the culture of agro forestry or ley farming system within the study area.

STATEMENT OF THE PROBLEM

Absent of tamarind seedlings among commercial gardeners during the implementation phase of JURIA project under AGRA-NEARLS fertilizer system research in collaboration with Kaduna State Agricultural Development Agency (KADA), when I was the general manager of the agency constituted a strong reason for conducting this research work in Agriculture Education Department, Federal University of Education Zaria, Kaduna State.

The existing situation have left many beverage industries and consumers in Nigeria dependent on naturally existing tamarind trees in the Sahel and Savannah zones as a major source for the pulp to the market or imported from neighbouring countries. It is a known fact that the naturally occurring germination rates of the plant will always result in inadequate planting stock, undermining the potential for large-scale tamarind cultivation with a growing high demand for the product in the market year-round (KADA, 2023)

Because of the existing gap between production and supply of tamarind pulp in the study area leading to high demand of the fruit in the market, Agriculture Education Department of the University took a bold step to conduct a research on the environmental requirements for tamarind seed germination and growth. Thus, conducting this research would not only support tamarind production practices alone, but can also have broader implications for enhancing rural

livelihoods of the farmers in the area of food, income and reduction in high dependency on synthetic fertilizers due to the high plant residue ability in replenishing soil lost organic matter in farmers degraded soils of the Sahel and Sudan savannah of Nigeria.

Objective of the Study

To identify the procedure and environmental requirements for tamarind seed germination in the study area.

Research Question

what is the procedure and environmental requirements for tamarind seed germination in the study area.?

METHODOLOGY

The research was carried out at the Agricultural Education Department Farm of the Federal University of Education, Zaria. The study was designed to determine the effects of different environmental conditions, particularly environmental temperature, watering regimes, and pre-treatment procedures in stimulating tamarind seed germination. The study involved four distinct trials, each aimed at exploring different variables affecting the seed germination process.

Seed Collection and Preparation

For the purpose of this experiment, mature tamarind pods were bought from the market. Only fully matured, undamaged pods were selected. The tamarind seeds were carefully extracted from the pods, cleaned to remove all debris, and then air-dried in a shaded, cool environment to prevent any fungal growth or moisture retention. The tamarind seeds were treated by scarification, a process in which the seed coat is mechanically damaged to promote better water absorption and break the seed's dormancy. As they are known to have a hard, impervious seed coat that often delays or inhibits germination. Additionally, a portion of the seeds was subjected to cold water treatment (for about 48 hours) to further improve the rate of water absorption and stimulate seed viability.

Experimental Design

The study employed four different trials conducted sequentially in the month of October November, December and January. The trials were designed only to stimulate tamarind seed germination, specifically to identify the environmental temperature requirement for tamarind seed germination, watering regime after planting, and seed pre-treatment before planting. The trials varied within environmental conditions and pre-treatment methods used, as detailed below:

First Trial (October)

- i. **Seed Pre-Treatment:** Seeds were only cleaned and planted directly without pre-treatment.
- ii. **Soil Type:** The seeds were sown in sandy-loam soil, which has good drainage properties but tends to dry out quickly under high temperatures.
- iii. **Environmental Conditions:** The seeds were planted in a sun-exposed area of the farm where they were exposed to daily maximum temperatures of 30°C to 35°C. The high temperature was likely responsible for soil dehydration and lack of seeds germination.
- iv. **Watering Regime:** Watering was done once daily in the evening.
- v. **Results:** After eleven days, no germination was observed. It was concluded that the high temperature of the environment was likely responsible for lack of seed germination or absent of desiccation procedures.

Second Trial (November)

- i. **Seed Pre-Treatment:** Seeds were soaked in warm water (38°C) for 48 hours to enhance hydration and encourage / faster seed germination.
- ii. **Soil Type:** This trial utilized loamy soil, which retains moisture more efficiently than sandy-loam soil, ensuring more stable soil moisture for seeds germination.
- iii. **Environmental temperature:** The temperature during this trial ranged between 27°C to 29°C. Though slightly lower than in

the first trial, the temperature was still considered high for optimal tamarind germination.

- iv. **Watering Regime:** Watering frequency was adjusted to after every one-day interval by the afternoon.
- v. **Results:** Despite improved soil conditions and adjust watering regime, after eleven days, there was minimal seedling emergence i.e most of the seeds showed swelling but did not proceed to full germination.

Third Trial (December)

- i. **Seed Pre-Treatment:** Seeds underwent hot water treatment (boiling water poured over the seeds, followed by cooling for 48 hours) to break dormancy and stimulate metabolic processes within the seeds.
- ii. **Soil Type:** This trial was conducted using well-prepared polythene bags with a mixture of loamy soil and compost, which provided both good moisture retention and sufficient drainage.
- iii. **Environmental Temperature:** The seeds were placed under a shade net to protect them from direct sunlight and excessive heat, maintaining the month of December average temperature range of 20°C to 25°C. The shade net have also help in regulating the environmental temperature, thus preventing it from exceeding the optimal range for germination.
- iv. **Watering Regime:** In this trial, watering was done every 24 hours, during the first one weeks to ensure the soil remained moist but not waterlogged. After ten days, watering was reduced to 48 hours to maintain a moderate moisture level without over-saturating the soil. The water quantity was added from 10cl to 20cl after successful germination was observed
- v. **Results:** After ten days, the first signs of germination were observed. By 15 days 60% of the seeds had successfully germinated, with healthy seedlings showing rapid growth. This success was attributed to the moderate environmental temperature range of the month of December, proper seed pre-

treatment, and the shading provided to protect the seeds from excess heat.

Fourth Trial (January)

- i. **Seed Pre-Treatment:** Seeds underwent hot water treatment (boiling water poured over the seeds, followed by cooling for 48 hours) to break dormancy and stimulate metabolic processes within the seeds.
- ii. **Soil Type:** This trial was conducted using well-prepared polythene bags with a mixture of loamy soil and compost, which provided both good moisture retention and sufficient drainage.
- iii. **Environmental Temperature:** The seeds were placed under a shade net to protect them from direct sunlight and excessive heat, maintaining an average January temperature range of 20°C to 25°C. The shade net also help in regulating the temperature of the environment, preventing it from exceeding the optimal range for germination.
- iv. **Watering Regime:** In this trial, watering was done every 24 hours, during the first one week to ensure the soil remained moist but not waterlogged. After ten days, watering was reduced to 48 hours to maintain a moderate moisture level without over-saturating the soil. The water quantity was added from 10cl to 20cl after successful germination in the second week after planting.
- v. **Results:** After ten days, the first signs of germination were observed. After 15 days 80% of the seeds had successfully germinated more than the percentage germination observed in the month of December, with healthy seedlings showing rapid growth. This success was attributed to the moderate environmental temperature range of the month of January, proper seed pre-treatment, and the shading provided to protect the seeds from excess heat too.

RESULTS AND DISCUSSION

Procedures to Stimulate Tamarind Seed Germination

To ensure successful germination, only mature and healthy tamarind seeds were chosen from the market. The seeds were visually inspected for damage and viability potential. The first step in the germination process was seed pre-treatment, which played a critical role in breaking dormancy. The seeds underwent a hot water treatment, which involved pouring boiling water over the seeds, followed by a period of cooling lasting for 48 hours. This method facilitates the activation of metabolic process within the seeds, in order to promote germination.

Furthermore, the seeds were sown in well-prepared polythene bags filled with a mixture of loamy soil and compost. This soil type was selected for its ability to retain sufficient moisture while allowing adequate drainage, essential for healthy seedling development. The combination of these preparatory steps initiated the germination process, allowing the seed's internal mechanisms to respond positively to the external environmental factors.

Environmental Temperature Requirements for Tamarind Seed Germination

The environmental conditions during germination are paramount; specifically, the temperature range proves to be a critical factor. In this study, the seeds were placed under a shade net that help to regulate temperature, maintaining an optimal range between 20°C and 25°C in the month of December to January. This temperature range is conducive in promoting metabolic activities and germination potential of the seeds.. The measured temperatures were monitored throughout the December and January trials, ensuring that they did not exceed the upper threshold of 25°C, which could potentially inhibit germination. The consistency of the temperature range played a significant role in the germination success rate observed after fifteen days in the month of December and January.

Watering Regime Requirements for Tamarind Seed Germination

Watering was meticulously managed during the trials to create a suitable environment for seed germination. In the initial ten days,

watering was done every 24 hours, ensuring that the soil remained adequately moist, critical for seed awakening. Following this period, the watering frequency was adjusted to every 48 hours. This alteration aimed at maintaining a moderate moisture level while avoiding over-saturation of the soil, which can lead to root rot and other complications. The specific volume of water applied varied, ranging from 10cl to 20cl, depending on the moisture needs post-germination. The careful adjustment of the watering regime was deemed necessary to optimize germination success and promote healthy seedling growth.

Pictorial Views of Tamarind Seeds After Treatment to Seedlings Stage During Experimental Research Trials in Agriculture Education Department F.U.E Zaria

Below are the pictorials views showing stages of tamarind seeds germination and growth during Research Trials as follows;



Figure 4.1: Pictorial View of Tamarind Seeds After Treatment



Figure 4.2: Soil Preparation in Polythene Bags for Tamarind Seeds Planting



Figure 4.3: Tamarind Seedlings During Germination in December Trials After Fifteen Days



Figure 4.4: Tamarind Seedlings During Germination in January Trials After Fifteen Days



Figure 4.5: Tamarind Seedlings After One Month of Germination

Corresponding author: Abubakar Bayero

✉ monyavevillabe50@gmail.com

Department of Agriculture Education, Federal University of Education Zaria, Kaduna State.

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Figure 4.6: Tamarind Seedlings After One Month of Germination



Figure 4.7: Tamarind Seedlings After Six Weeks of Germination (December Trials)



Figure 4.8: Tamarind Seedlings After Six Weeks of Germination (January Trials)



Figure 4.9: Tamarind Seedlings After Two Months of Germination

CONCLUSION

Based on the research Trails conducted in respect of environmental requirement for Tamarind Seed germination, Seed treatment, Soil selection, watering Regime and Temperature constitute a very vital environmental factors for tamarind Seed germination in the study area with low temperature been the most significant factor in determining the germination potential or dormancy of the seeds among others. Hence, to be able to maintain low temperature of the environment during tamarind seed germination, it is recommended that tamarind seeds germination trials should be conducted during the month of December or January when environmental temperature are very low during harmattan period provided another requirement.

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