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Full Length Research

Pre-Sowing Treatments for Improved Germination and Growth Performance of Tamarind (*Tamarindus indica*) in Wukari, Taraba State, Nigeria

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Seed germination of tree species is important for development of plant growth to achieve the aim of regeneration programme. The study was conducted to determine the effect of tamarind (*Tamarindus indica*) to pre-germination seed treatments and growth performance in the nursery. In this study, twenty four (24) replicas of *Tamarindus indica* seeds were subjected into five pre-treatments: mechanical scarification, soaking in 97% concentrated sulphuric acid (H_2SO_4) for 15 minutes, soaking in cold water for 24 hours, soaking in hot water for 30 minutes and untreated (control) seeds. Seeds were sown in poly pots under normal environmental condition for germination. The highest germination percentage was recorded in seeds treated by mechanical scarification (87.50%) at day 8, followed by 97% sulphuric acid (H_2SO_4) (79.16%) concentration within fifteen (15) minutes soaking period at day 10 and the least was hot water (41.66%) with 30 minutes soaking period at day 15. Germination was observed to be enhanced by the effect of mechanical scarification on disrupting the seed coats of Tamarind, followed by sulphuric acid (H_2SO_4) and the least was by hot water. The results were tested at 5% significant level and it showed that the pre-germination treatments have a significant effect on germination and growth performance (height, stem diameter and number of leaves) of *Tamarindus indica*. Therefore, the study recommended mechanical scarification and concentrated Sulphuric acid for 15 minutes for seed germination, although care must be taken in handling the acid considering the risk. Results of this study can serve as useful information in the production, improvement and regeneration of the economic tree species, as basic knowledge on seed germination requirements is an important factor in seedlings production.

Keywords: *Tamarindus indica*, germination, treatments, growth performance.

INTRODUCTION

Tamarind (*Tamarindus indica* L: Leguminosae), is an indigenous legume fruit tree of the tropics reported to be underutilized worldwide. *Tamarindus indica* possesses great potential to address various nutritional, health, socioeconomic and environmental constraints (Ebifa-Othieno et al., 2017). It is important to rural communities as a major raw material for soft drinks and pharmaceuticals especially in the northern part of Nigeria where it is known as tsamiya (Okoro et al., 1986). The growth and management of *Tamarindus indica* and often other tree species lies in the hands

of local farmers who have little or no understanding of silvicultural practices that can hasten the germination of the species.

Despite the importance of *Tamarindus indica* for food, wood, and medicinal values, today only few stands of the species remained due to over exploitation without proper management and effective forest laws. In Nigeria it is often exploited more or less in the wild. The aging tree stands are gradually dying without replacements and seeds do not germinate on their own accord, possibly due to lack of the factor that is required to break the dormancy (Muhammad and Amusa, 2003). Deforestation and desertification have caused loss of many important tree species in Nigeria, threatening our rich reserve. These resultant negative effects can be minimized through afforestation or reforestation programmes. Although germination of seeds is often very difficult for many useful species mainly because of dormancy, to achieve the aim of any regeneration programme, seed collection and germination must be taken into consideration (Bello and Gada, 2015). Hence, it is necessary to identify the most appropriate way of raising seedlings under different seed treatment methods in the nursery.

The seeds of most wild plants and legumes require a period of dormancy before they will germinate. This genetic requirement ensures that the seed will wait at least until the next favorable growth period. Some seeds can remain dormant and yet viable with embryo in a state of suspended animation for hundreds of years (Abubakar and Muhammad, 2013). For Tamarind, the seed is hard and can remain viable for months (El-Siddig et al., 2006). A dormant seed does not have the capacity to germinate in a specified period of time under any combination of normal physical environmental factors that are otherwise favorable for its germination, that is, after the seed becomes non-dormant (Baskin and Baskin, 2004). A completely non-dormant seed has the capacity to germinate over the widest range of normal physical environmental factors possible for the genotype (Abubakar and Muhammad, 2013). The role of *Tamarindus indica* in environmental protection cannot be over emphasized. The wide spread canopy of the tree clearly shows its ability to provide protection from harsh weather as well as shade for humans and livestock, hence the need for conservation and management strategy. The purpose of the research is to examine the effect of tamarind (*Tamarindus indica*) to pre-germination seed treatments and growth performance under normal environmental conditions.

METHODOLOGY

The study was carried out at the nursery established by the Department of Forestry and Wildlife Management, Federal University Wukari, Taraba state which is located at longitude 9.78^0E and latitude 7.85^0N and 152 meters elevation above sea level.

Pot Filling: Prior to the filling of containers, the soil was sieved using 2 millimeter mesh to remove stones and other particles. The cow dung was also crushed and sieved. A 25 × 12 cm sized polythene bags were filled with soil mixtures in the nursery: manure/topsoil/river sand (1: 1: 2).

Treatment Procedure

Five (5) pre-treatment methods were used for breaking the seed dormancy of *Tamarindus indica* in this study;

Mechanical scarification: twenty-four (24) seeds of tamarind were scarified by nicking the seed coat with knife before sowing directly into the poly pots.

Concentrated Sulphuric Acid: Twenty-four (24) seeds of tamarind were soaked in 97% of concentrated sulphuric (H_2SO_4) for 15 minutes before direct sowing into the poly pots for early growth assessment.

Hot Water Treatment: Twenty-four (24) seeds of tamarind were soaked in hot water that boiled to a temperature of 100◦C for 30 minutes and allowed to cool before sowing.

Cold Water Treatment: Twenty-four (24) seeds of tamarind were soaked in cold water for 24 hours at normal room temperature and then sown directly into the poly pots.

Untreated (control) seeds: Similarly, twenty-four (24) seeds of tamarind were not treated and sown into poly pots.

Seed Sowing: According to Colleen (2014), seed should be planted at a depth of three times its

Table 1. Effect of pre-treatment on germination of *Tamarindus indica* seeds.

Pre-treatment	No of days before Germination	Number of seed Germination	Germination percentage (%)
Mechanical scarification	8	21	87.50
Concentrated H_2SO_4	10	19	79.16
Hot water	15	10	41.66
Cold water	11	16	66.66
Untreated (control)	14	14	58.33

Source: Field survey (2017).

diameter. However, for the purpose of this research, the sowing depth was 3 cm. Watering was carried out once in a day (early morning) and twice in a day after complete germination (i.e., early morning and late evening). The daily seeds germination was observed for 12 weeks after the sowing day. The seed that was considered as germinated was those whose seed split and their plumule grows upward from the poly pot.

Parameter measurement: Growth height, stem diameter, and leaf number were measured after two (2) weeks of germination.

Growth height: the height was measured using a centimeter ruler from the soil level to the tip of the seedling.

Stem diameter: The stem diameter was measured using a thread tied round the stem of the seedling and then measured with a centimeter ruler.

Leaf number: Leaf number was determined by counting the number of leaves on the seedling daily.

Germination percentage (G %) was computed as the ISTA (2011) using the following equation:

$$G\ (\%) = \frac{\text{No.of germinated seeds}}{\text{Total seed number}} \times 100$$

EXPERIMENTAL DESIGN

Data was subjected to Completely Randomized Design (CRD) or one way analysis was used after observation for a period of 12 weeks in order to know the difference between the treatments and means separation was done with Duncan Multiple Range Test (DMRT) which was used for the post-hoc (Test of significance).

RESULTS AND DISCUSSION

Germination Assessment of *Tamarindus indica*

The germination result of *Tamarindus indica* treated with different methods of breaking seeds dormancy were obtained from the data collected for a period of 12 weeks.

Mechanical scarification showed complete germination after 8 days and gave highest germination percentage (87.50%) followed by soaking in concentrated H_2SO_4 (79.16%) whose complete germination was within 10 days and the least was seeds soaked in hot water with germination percentage of 41.66% after 15 days. Seeds pretreated by mechanical scarification had the highest number of germination (21), followed by concentrated H_2SO_4 (19) and the least was hot water treatment. The result evidently shows that all the pre-treatment methods used are effective in hastening germination of tamarind compared to the untreated seeds (Table 1). This supports the finding of Byrd (1971) who reported that reduced germination percentage and seedlings vigour were observed due to high temperature which is very common with seeds that are exposed to great heat, especially when hot water and light burning pretreatment are applied to seeds in order to break their dormancy. Macdonald and Conrad, (2015) stated that poor germination recorded for H_2SO_4 (15 minutes) and hot water treatments was due to charring and burning of seeds as a result of prolonged exposure. Mozumder, S., Khan, B., and Rahman, M., (2018), also reported that seeds pretreated with hot water had the lowest germination percentage. The result of the experiment is

Table 2. Effect of pre-treatments on growth parameters (height, stem diameter and leaf number) of *Tamarindus indica*

Treatment	Height				Stem diameter				Leaf Number			
	WK 6	WK 8	WK 10	WK 12	WK 6	WK 8	WK 6	WK 12	WK 6	WK 8	WK 10	WK 12
Mechanical scarification	5.18ab	6.79b	8.12a	9.69a	0.27a	0.44a	0.76ab	1.34a	4.13a	6.19a	8.38a	10.19a
Concentrated H_2SO_4	5.56a	5.57a	7.76a	9.24a	0.22a	0.22c	0.66ab	1.04b	3.56a	3.56d	7.06b	8.94b
Hot Water	3.76d	5.34a	6.02d	6.53d	0.14a	0.27c	0.38b	0.54e	2.63b	4.00cd	5.00d	5.81e
Cold Water	5.09b	5.57a	7.11b	8.42b	0.20a	0.33b	0.92a	0.87c	3.56a	5.19b	7.00b	8.33c
Control	5.18ab	6.79b	8.12a	9.69a	0.27a	0.44a	0.76ab	1.34a	3.63a	4.38c	6.31c	7.48d

*N = Number. Values with the sample alphabet in the sample column and same section are not significantly different at P < 0.05 using Duncan Multiple Range Test (DMRT).

dissimilar with that of Abubakar and Muhammad, (2013) and Bello and Gada, (2015) who revealed that soaking of *Tamarindus indica* seeds in hot water at 100°C for 30 minutes had a percentage germination of 80% at the period of fifteen (15) and twelve (12) days after sowing respectively. The study also disagrees with Muhammad and Amusa, (2003) who reported that Hot water soaking gave higher percentage germination than ordinary water. Okoro *et al.,* (1986) also reported that hot water treatment and sulphuric acid affect the germination rate of tamarind and seed germination increased with increasing water temperature and soaking time.

GROWTH PARAMETERS

It is apparent from the data that height of seedlings was significantly influenced by different treatments at various weeks after sowing. Table 2, shows that the effect of pre-treatments on *Tamarindus indica* varies considerably (P < 0.05) indicating an increase in height. The follow-up test conducted using Duncan Multiple Range Test (DMRT) at 5% shows that all the germination treatment methods differ significantly. Seeds pretreated by mechanical scarification (9.69) had the highest growth height and the least was hot water treatment (6.53). However, there is no significant difference in growth height between concentrated H_2SO_4 and mechanical scarification. Treated seeds did better than the untreated seeds because of the exposure of seeds to the pre-treatments. Seed germination occurs as a result of seed coat ruptures due to pre-treating of *Tamarindus indica* seeds with concentrated H_2SO_4, hot water and cold water prior to the soaking period. According to Wang, Y., Hanson, J., and Mariam, Y., (2007) most pre-treatment significantly reduce hard seed content and improve germination percentage and rate of growth. Table 3 shows an increment in height of *Tamarindus indica* from 4.84±0.08 to 8.31±1.29. The result also shows that there is significant difference (P < 0.05) in the stem diameter of *Tamarindus indica* using different treatments using Duncan Multiple Range Test (DMRT) at 5%. However, there is no significant difference in the various treatments of seeds in week 6. There was a slight increase in the stem diameter of *Tamarindus indica* from 0.40±0.85 to 0.88±0.31 (Table 3).

The highest number of leaves was recorded for mechanical scarification and hot water treatment was the least. From Table 3, the result shows that there is an increase in the number of leaves of *Tamarindus indica* from

Table 3. General Mean Values of Germination and Growth Variation in *Tamarindus indica*

Week	6	8	10	12
Growth Parameter				
Height	4.84±0.89	5.81±0.96	7.12±0.96	8.31±1.29
Girth	0.40±0.85	0.30±0.11	0.64±0.61	0.88±0.31
Leaf Number	3.50±0.87	4.66±1.17	6.75±1.37	8.07±1.67

*Means ± SEM (Standard Error of Mean) of 4 replicate samples per treatment.

3.50±0.87 to 8.07±1.67. Soaking tamarind seeds for 24 hours as for cold water, 30 minutes for hot water, and 15 minutes for concentrated sulphuric acid (H_2SO_4) may have accelerated the hydrolysis of complex sugar into simple sugars which are then utilized in the synthesis of auxin and protein. It is known that proteins are utilized in the production of new tissues and that auxin promote growth in plants. This probably explains the higher values recorded for various growth parameters under various treatments with different soaking time. Patel, (2017) revealed from her study that soaking hour had significant effect on growth parameters. Mechanical scarification and concentrated H_2SO_4 allowed for nutrients and oxygen to penetrate easily reducing the time for permeability and hasten germination and growth. The increase in seedling height maybe due to the fact that these treatments affect the hormone responsible to increase osmotic uptake of nutrients, causing cell elongation and thus increase the height of the plant and stem diameter also increased due to greater cell division and elongation experienced at the stem portion (Patel, 2017). The result of the present study agrees with Abubakar and Muhammad, (2013) who reported that concentrated H_2SO_4 gave higher leaf number and seedling height than hot water and untreated (control) respectively.

CONCLUSION AND RECOMMENDATION

Under natural condition, *Tamarindus indica* takes much time to germinate because of its hard coat, which creates dormancy and slows down germination process. Therefore, the results of the present study demonstrated that *Tamarindus indica* seeds, when treated with mechanical scarification, soaking the seeds in concentrated H_2SO_4 for 15 minutes and soaking in cold water for 24 hours indicated better germination execution and growth parameter. Hence, these pretreatments are very essential in breaking dormancy and hastening germination of *Tamarindus indica* seeds. Care must be taken while handling Concentrated H_2SO_4 and nicking the seeds with knife or any other form of mechanical scarification to avoid damage to the seed. Avoid over soaking the seeds in sulphuric acid as it may pit the seeds and expose the endosperm making germination impossible.

REFERENCES

Abubakar Z and Muhammad A (2013). Breaking Seed Dormancy in Tamarind (*Tamarindus Indica*) A Case Study of Gombe Local Government Area. Journal of Applied Sciences and Environmental Management, 83-87.

Agboola DA and Etejere E (1991). Studies on seed dormancy of selected economic tropical forest species. Nigerian journal of Botany.

Baskin C (2001). Seeds Ecology, Biography and Evolution of Dormancy and Germination. London, UK: Academic Press.

Baskin MJ and Baskin CC (2004). A classification system for seed dormancy. Cambridge University press, pp. 1-66.

Bello AG and Gada ZY (20150. Germination and Early Growth Assessment of Tamarindus indica L in Sokoto State, Nigeria. International Journal of Forestry Research, Article ID 634108, 5 pages.

Colleen V (2014). How to tellhow deeplyseeds should be planted.

http://organicgardening.about.com/od/organicgardening101/eedplantingdepth.htm18/06/2014.

Curtis H and Barnes NS (1983). Invitation to biology, third edition. Worth publication, INC. New York, USA.

Ebifa-Othieno E, Mugisha A, Nyeko P and Kabasa, JD (2017). Knowledge, attitudes and practices in tamarind (*Tamarindus indica* L.) use and conservation in Eastern Uganda. Journal of Ethnobiology and Ethnomedicine, 13:5.

El-Siddig K, Gunasena H, Prasad B, Pushpakumara D, Ramana K, Vijayanand P and Williams JT (2006). Tamarind, *Tamarindus indica* L. . Southampton, UK: Southampton Centre for Underutilised Crops, pp 188.

ISTA (2011). International Rules for Seed Testing. Zurich: Switzerland.

Macdonald I and Conrad AO (20150. Effect of various pre-treatments on the seedling growth performance of *Tamarindus indica* L. Association of Official Seed Analysts and Society of Commercial Seed Technologists.

Mozumder S, Khan B and Rahman Md. R (2018). Pre-sowing Treatments for Improved Germination and Growth Performance of *Tamarindus indica* L. in Bangladesh. Asian Journal of Biological Science, 11: 120-129.

Muhammad S and Amusa NA (2003). Effects of sulphuric acid and hot water treatments on seed germination of tamarind (*Tamarindus indica* L). African Journal of Biotechnology, 2 (9): 276-279.

Okoro S, Awodola A and Itolo G (1986). The impact of selected tree species on the soil properties in a Sudan Savanna Forest. Proceedings of 16th Annual Conference of Forestry Association of Nigeria, Pp. 60-667.

Patel RM (2017). Response of soaking time and chemicals on germination and growth of tamarind (*Tamarindus indica* L.). Department of fruit science Aspee college of horticulture and forestry Navasari Agricultural University.

Samia MEB and Nahed MR (2018). Influence of Pre-germination Treatments on Overcoming Seed Dormancy and Seedling Growth of Baobab (*Adansonia digitata* L.). Zagazig Journal Agricultural Resources, 45 (2).

Wang Y, Hanson J and Mariam Y (2007). Effect of sulphuric acid pre-treatment on breaking hard seed dormancy in diverse accrssions of five wild Vigna species.