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ASSESSMENT OF PRE-SOWING TREATMENTS ON GERMINATION AND EARLY GROWTH OF TAMARIND (*Tamatindus indica L.)* IN KANO STATE NIGERIA

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ABSTRACT
The experiment was conducted in order to assess the effect of pre-sowing treatment on germination and early growth of Tamarindus indica using different pre-sowing methods at the screen house faculty of Agriculture, Bayero University Kano. One hundred and fifty (150) seeds were collected and tested for viability out of which 85 seeds proved positive. 75 seeds were divided into five groups 15 seeds for each treatment and control. The experiment was laid in a completely randomized design (CRD) with three replications. Data on germination rates, seedling height, number of leaves, number of branches and collar diameter were recorded. The data collected were then summarized and presented using descriptive statistics as well as Analysis of variance (ANOVA). Mechanical scarification recorded the highest germination rates followed by cold water treatment and NaOH while control and hot water treatment recorded the lowest value. The results of ANOVA conducted indicated no significant differences between the treatments (P>0.05 seedling height, P>0.05 collar diameter) i.e the height growth and collar diameter are same with respect to their means all the treatments. Correlation analysis conducted to establish linear relationship between the variables indicated a positive relationship between all the variables compared

1. INTRODUCTION

Seed germination does not take place easily even when a suitable environment for germination available (Zabala, 1990). According to Azad *et al.* (2012) it is expected that seed treatments will guarantee both seed germination success and synchronization of germination. Dormancy in seeds could is assumed to be

simply a block to the completion of the germination process of a viable seed under favorable condition. (Finch Savage and Leubner-Metzger, 2006). A dormant seed is said to lack the ability to germinate within a specified period of time even under normal physical environmental factors favourable for germination, i.e. after the seed become 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 Seed dormancy is defined as an inherent seed property that prevents germination in plant during unfavorable condition, that is, when the probability of seedling survival is low (Black and Halmer, 2006).

Seed germination mostly starts with the uptake of water by the dormant dry seed causing the embryonic axis to become elongated (Holdsworth *et al.*, 2008). The seed of most arid and semi-arid tree species cannot germinate promptly when introduced to conditions favorable for germination due their impermeable coats. Seeds of such species need to be subjected to some physical or chemical treatments to break dormancy and obtained uniform germination. As indicated by various studies, one of the major difficulties faced when cultivating important species that contribute immensely to socio-economic development of a nation is poor germination success or longer duration in germination time. This, in turn, has discouraged many from participating in such species cultivation. However, germination success can be improved by adopting appropriate pre-sowing treatment techniques (Koirala *et al.*, 2000; Alamgir and Hossain, 2005; Azad *et al.*, 2006). Seeds of many species do not germinate well unless they are exposed to certain conditions. This state of not germinating unless the required conditions are met is called dormancy. In the natural environment the conditions may be exposed to fire or being eaten by animals. There are several methods of pretreatment but knowledge of a few simple techniques is sufficient to get reasonable germination of almost all species. Seed germination is the emergence and growth of embryo to young plants by rapture of seed coat. It is an important and vulnerable stage in the life cycle of terrestrial angiosperm and determines seedling establishment and plant growth. Sometimes the seeds cannot germinate even in the presence of both environmental and biological conditions responsible for germination and this is called dormancy.

Tamarindus indica is a leguminous tree in the family Fabaceae native to tropical Africa. *Tamarindus indica* is best known for its delicious fruit. The edible portion of the fruit is brown, sticky and sour in taste with a peculiar flavour that is used in a variety of dishes and drinks (Ajiboye, 2010). The usefulness of the tamarind tree does not end with its fruits. The tamarind tree is widely distributed or more appreciated as an ornamental plant in the tropics. It is sometimes compared to the coconut as another "tree life", it is widely adaptable and easily managed. It produces many-valued foods, medicine, wood and construction products. The tree is drought resistant, strong and performs well as windbreak. It also prevents soil erosion, protects people`s homes crops and animal in harsh environments and also plays crucial beautification role in thousands of parks (Abubakar and Muhammad, 2013). Tamarind is traditionally propagated by seed; tamarind produces relatively large seeds that average between 11-12.5 mm in diameter. They are flattish, shiny brown to blackish, with a hard-impermeable seed coat. Germination of tamarind seed is epigeal. The socioeconomic importance of majority indigenous tree species to the people of this area cannot be overemphasized especially during the dry season when sources of income become short. Therefore, planting of economic indigenous tree species like T. *indica* will not only help in protecting the farmlands and the environment generally and conserving biodiversity in this ecological zone but will also help in uplifting the economy of the people in the area majority of who are peasant farmers.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in the Screen House of the Faculty of Agriculture, Bayero University Kano,

Nigeria. Kano is found within latitude 11^0 58'N and longitude 8^0 26'E. It has a landmass of about 20,680.00 km^2, the population of Kano State is about 9,383,682 Census, (2006). Population density 454km. Kano State is bordered by the states of Jigawa to the North and East, Bauchi to the Southeast, Kaduna to the Southwest, and Katsina to the Northwest. The vegetation of Kano state is semi-arid savanna, wooded savanna in the South and scrub vegetation in the North, the soil type is light sandy soil. The temperature of Kano usually ranges between a maximum of 33^0C and a minimum of 15.8^0C although sometimes during harmattan falls down to low as 10^0C. Kano state has two seasonal periods, which consist of four to five months of wet season which start from May and ends in September, and a long dry season lasting from October to April. The average rainfall is between 63.3mm + 48.2mm in May and 133.4mm + 59mm in August the wettest month.

2.2 Seed collection and Viability Test

The seeds of *Tamarindus indica* were obtained from Rimi market Kano State Nigeria. Seeds from the fruit were carefully extracted using a sharp knife. The seeds were dipped in water in order to test for viability. Those seeds that sink or settle down at the bottom of the container were considered viable, while the floated ones were said to be empty or non-viable seeds

2.3 Experimental Design

The experiment was laid in a Completely Randomized Design (CRD) having Five (5) treatments and three replications. A method of breaking seed dormancy described by Al-Fredan and Ali (2008) was adopted in this research.

Sodium hydroxide (NaOH) was obtained from the department laboratory. Tap water was boiled to a boiling point using an electric heater at the onset of the experiment and then normal tap water was collected. For this trial, seeds of *T. indica* were soaked into a beaker containing NaOH solution for 30 minutes and accompanied by regular stirring in order to ensure equal treatment of the seeds. The treated seeds were washed thoroughly with water and drained in moisten filter paper. A beaker was filled with water and heated to a temperature of 100^0 C using electric heater. The seeds were then transferred into the boiled water. The seeds were stirred regularly and allowed the seeds to stay in the hot water for a period of one hour and then removed, and drained on moistened filter paper.

The seeds were soaked in a beaker containing water at room temperature for 12hrs. The seeds were removed and transferred to Petri dishes containing moistened filter paper. The seeds were scrubbed repeatedly on the coarse sand paper which resulted in the reduction of the thickness of the seed coat. The seeds were then transferred to Petri dishes containing filter paper. For this trial the seeds were assigned directly into a Petri dishes containing moisten filter paper the seeds were not treated at all.

2.4 Data Collection

Data on germination from each treatment was recorded after five days until at least 75% of the seeds from the treatment germinated. Germination and growth parameters obtained include the followings.**,** Number of seeds sown**,** Number of seedlings emerged**,** Seedlings height, Seedlings collar diameter**,** Number of leaves, Number of branches. Seedling height was measured using meter rule while collar diameter was determined using Vanier callipers

Fig. 1: Seeds after viability test

Fig. 2. Seeds after treatment

Fig. 3: Seedling after germination during data collection

2.5 Data Computations and Analysis

Germination indices were calculated using the following formulae adopted by Fakorede and Ojo (1981) and Fakorede and Ayoola (1980)

(1)

(2)

(3)

The data collected were organized and screened for analysis. Descriptive statistics were used to give summary statistics of the data, pie chart, bar chart and percentages were used to present the results of seedling emergence and early growth. The data were subjected to analysis of variance (ANOVA) to see whether significant differences exist between treatments, GENSTAT Version 11 was used for data analysis

3. RESULTS

3.1 Growth Parameters

Table 1 below shows the summary statistics of the data collected (variables). The means of the variables are as follows, Height=16cm, Collar diameter=2.88(mm) No. of leaves=200, No. of Branches=13

Table 1: Summary statistics of Growth Parameters

	Summary Statistics			
	Min	Max	Mean	SD
Height (cm)	14.00	20.00	16.88	1.74
Collar Diameter (mm)	2.09	3.23	2.88	0.32
Number of Leaves	142.00	254.00	200.00	32.7
Number of Branches	10.00	16.00	13.00	1.68

***Min=Minimum, Max=Maximum, Mean=average, SD= Standard Deviation.**

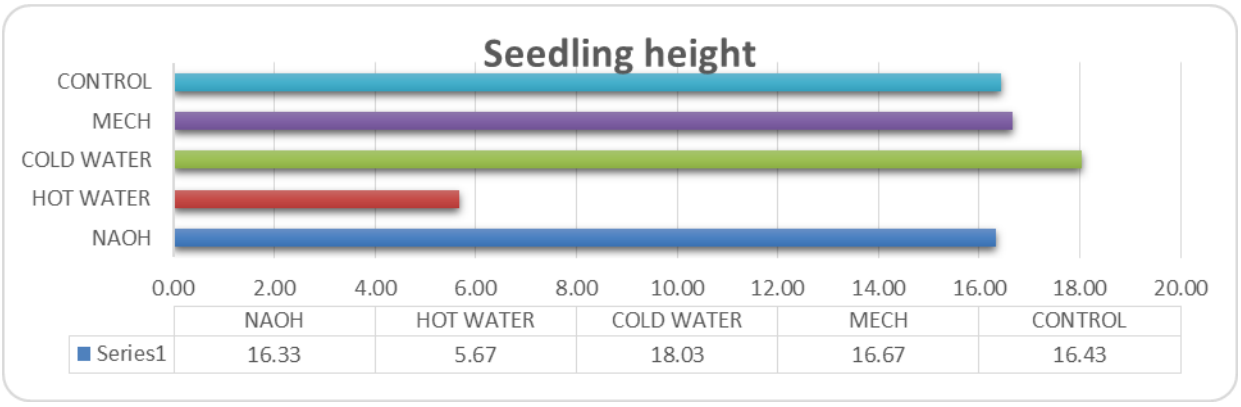

Figure 4: Seedling height (cm) based on treatments

Fig.5 below shows that cold water treatment has the highest value and hot water recorded the lowest.

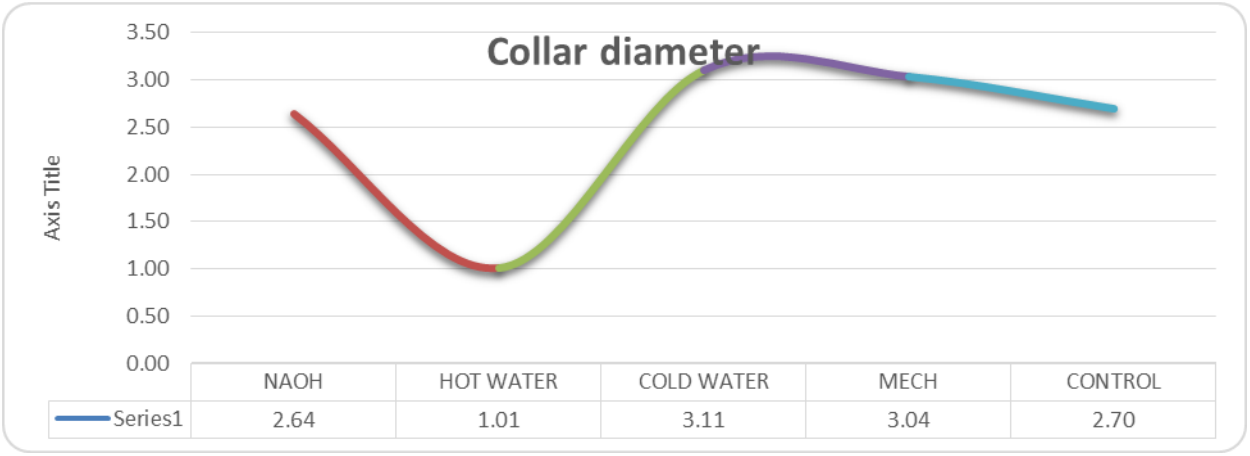

Figure 5: Collar diameter of *Tamarindus indica* by treatments

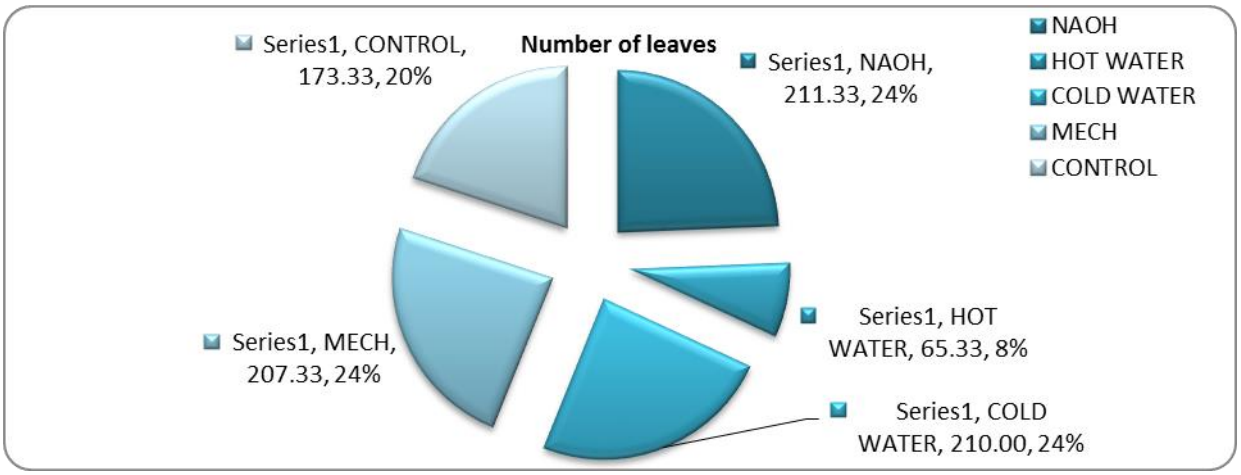

Figure 6: Number of leaves of *Tamarindus indica* in (%)

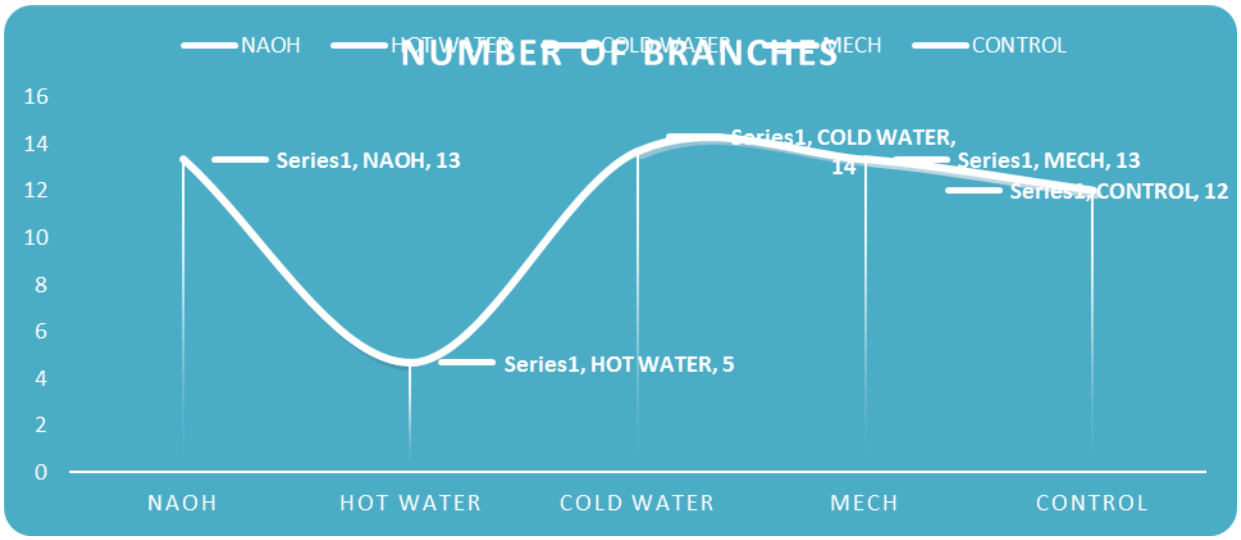

Figure 7: Number of branches of *Tamarindus indica*

3.2 Germination percentage

Tamarindus indica seeds treated with mechanical scarification recorded the highest germination rate with 66.7%, while hot water treated seeds recorded the lowest rate of germination with 6.7%

Table 2: Germination percentages based on treatments

S/N	Treatments	%
1	Cold water	46.7%
2	Mechanical Scarification	66.7%
3	Control	33.3%
4	NaOH	40%
5	Hot Water	6.7%

Emergence Index 1.48, **Emergence Rate Index** 0.038, **Emergence percentage** 38.7%

3.3 Analysis of variance

Table 3 shows no significant differences in the treatments as the p-value= 0.8 and 0.3 which are greater than the level of significant 0.05.

Table 3: ANOVA Table

Seedling height

S. v	df	Ss	Ms	Vr	Fpr
Treatment	4	5.6	1.4	0.37	0.8
Residual	8	30.6	3.8		
Total	12	36.3			

Collar diameter

S. V	df	Ss	Ms	vr	Fpr
Treatment	4	0.5	0.13	1.46	0.3
Residual	8	0.7	0.08		
Total	12	1.2			

Anova table showing results of the analysis (p>0.05)

3.4 Relationship between Growth Parameter

The table below the present relationship between the measured variable, all relationships are positive with only three relationships discovered to be non-significant.

Table 4. Correlation table Growth parameters

	Days of Germination	Height (cm)	No. of Leaves	No. of Branches	Collar Diameter
Days of Germination	1				
Height (cm)	0.493	1			
No. of Leaves	0.575*	0.944**	1		
No. of Branches	0.498	0.968**	0.991*	1	
Collar Diameter	0.462	0.970**	0.910**	0.934**	1

***Correlation is significant at 0.05level (2-tailed) ** Correlation is significant at 0.01level (2-tailed)**

4.0 DISCUSSIONS

4.1 Growth Parameters

Since the study was conducted on the effect of pre-sowing treatments on germination and early growth (seedling growth) of *Tamarindus indica* it was indicated that seeds treated with cold water, mechanical scarification and NaOH recorded the higher height, number of leaves, number of branches and collar diameter compared with the seeds treated with other methods chosen in the study (control and hot water treatment).

4.2 Germination percentage

Mechanical scarification was the best and has the highest germination percentage (66.7%). Followed by cold water treatment with (46.7%), and NaOH with (40.0%), while the control had (33.3%) and hot water recorded the least germination with (6.7%). These results are in disagreement with the result obtained by Abubakar and Muhammad (2013) obtained percentage germination of 20% which is greater than the value obtained in this research using hot water for an hour. This may be as a result of long duration of soaking which might have affected the embryo. Similarly, all the results obtained were less than that obtained by Muhammad and Amusa (2003). At fifteen (15) days after sowing, the germination percentage was 80%.

The lowest germination percentage of 6.7% was observed from hot water (100%C) pre-treatment, this is in accordance with the findings of Byrd (1971) that reduced germination percentage and seedlings vigor were observed due to high temperature which is very common with seeds that are exposed to intense heat, especially when hot water and a light burning pre-treatment are applied to seeds in order to break their dormancy. However regardless of the purpose of plantation establishment, NaOH, mechanical scarification, cold water and hot water pre-treatments are very essential in breaking dormancy and hastening germination of *Tamarindus indica* seeds. This is as a result of treatments ability to soften seed coat, making it permeable for water and nutrients.

4.3 Pre-sowing treatment

Mechanical scarification method happens to give the highest germination rate with 66.7% followed by cold water treatment with 46.7% based on this research and also cold-water treatment and mechanical scarification had a higher growth rate. It is recorded that cold-water treatment and mechanical scarification are the best pre-sowing treatments on *Tamarindus indica* seeds. Since the p-value of seedling height (0.8) is greater than the level of significant 0.05, this shows that there is no significant difference in the height of the seedlings with respect to their means in all the treatments. Also, the p-value of the collar diameter (0.3) is greater than the level of significant 0.05, then this shows that there is no significant difference in the seedling collar diameter. Finally, all the treatments show no significant differences with respect to growth parameters. The result of ANOVA observed disagreed with the findings of Abubakar and Muhammad (2013) where significant difference was obtained between the treatments.

4.4 Relationships between growth parameters

A positive relationship was observed in all the parameters tested, all relationships appears to be positive., majority of the relationships are significant while few are not. From this linear relationship it is observed that increase in one variable lead to the increase in the other. Days of germination lead to increase in leaf number, number of branches, collar diameter, and plant height and this is observed with all the measured variables.

CONCLUSION AND RECOMMENDATIONS

Conclusively, mechanical scarification has the highest germination rate followed by cold water treatment and NaOH, while control and hot water treatment had the lowest effect. The effect of cold water, mechanical scarification, and chemical treatments on the growth parameters (seedling height and collar

diameter) were statistically similar (P>0.05) Finally, the researcher recommends the following: Floatation method of viability test should be employ as it is cheap, fast and easy to adopt, Seeds should be tested for dormancy as many seeds eventually have high dormancy period and research work should be done to figure out many simple and effective methods of breaking seed dormancy, The time used for chemical and hot water pretreatment should not take longer period, as long time soaking of *Tamarindus indica* seeds in chemical and heat may destroy seeds embryo thereby stopping the germination permanently.

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