Effect of Different Pre-sowing Treatment on *Ziziphus mauritiana* (Indian jujube plum) Seed Germination and Seedlings Growth Performance in Aliero, Kebbi State, Nigeria

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Abstract

The study was conducted in Kebbi state University of Science and Technology, Aleiro at tree seedling nursery, Forestry Department to determine the effect of different pre sowing treatment methods on ziziphus mauritiana. seeds germination and seedling growth performance, using six treatment. The experiment was laid out in a Randomized Completely Block Design (RCBD) with six replicates. The result showed that the untreated seed recorded the highest germination percentage (66.6%), followed by scarification (61.1%) then hot water (50%), cold water (16.6%). There was no significant difference (P>0.05) between treatments on plant height. Plant treated with scarification recorded the highest collar diameter mean value (2.56mm) while hot water (0.70mm) and sulphuric acid (0.55mm) recorded the least. Similarly untreated seeds recorded the highest number of leaves per plant (11.66) and the least number of leaves per plant was recorded in the hot water (4.21) and sulphuric acid (3.00). Scarification should be used to produce best early seedling growth performance. Further research should be conducted to explore the used of other pre-sowing treatments on Ziziphus mauritiana. seed germination and early growth performance.

Keywords: *Zizyphus, Seeds, Seedlings, Pre-Sowing, Leaves, Propagatin, Collar, Germination, Treatments, Plant, Hieght, Untreated, Growth*

Introduction

The Indian jujube, also known as *ziziphus*, is grown and cultivated in India, Russia Southern Europe, China and the Middle East. The fruit has been used in Chinese medicine for over 4,000 years. In India, the jujube is grown for just a few niche markets. Indian jujube (*Ziziphus mauritiana Lamk*.) is also known as ber, desert apple or Indian plum. It belongs to family Rhamnaceae. It is a tropical/subtropical fruit native to the northern hemisphere (Lyrene, 1979). The genus *Ziziphus* has 135 to 170 species (Islam and Simmons, 2006), of which 17 are native of India (Singh *et al.*, 2000).

Z. mauritiana. is cultivable ber in drier parts of the Indian subcontinent (Sebastian and Bhandari, 1990). Ber is also cultivated on marginal lands in some African countries (Johnston, 1972).

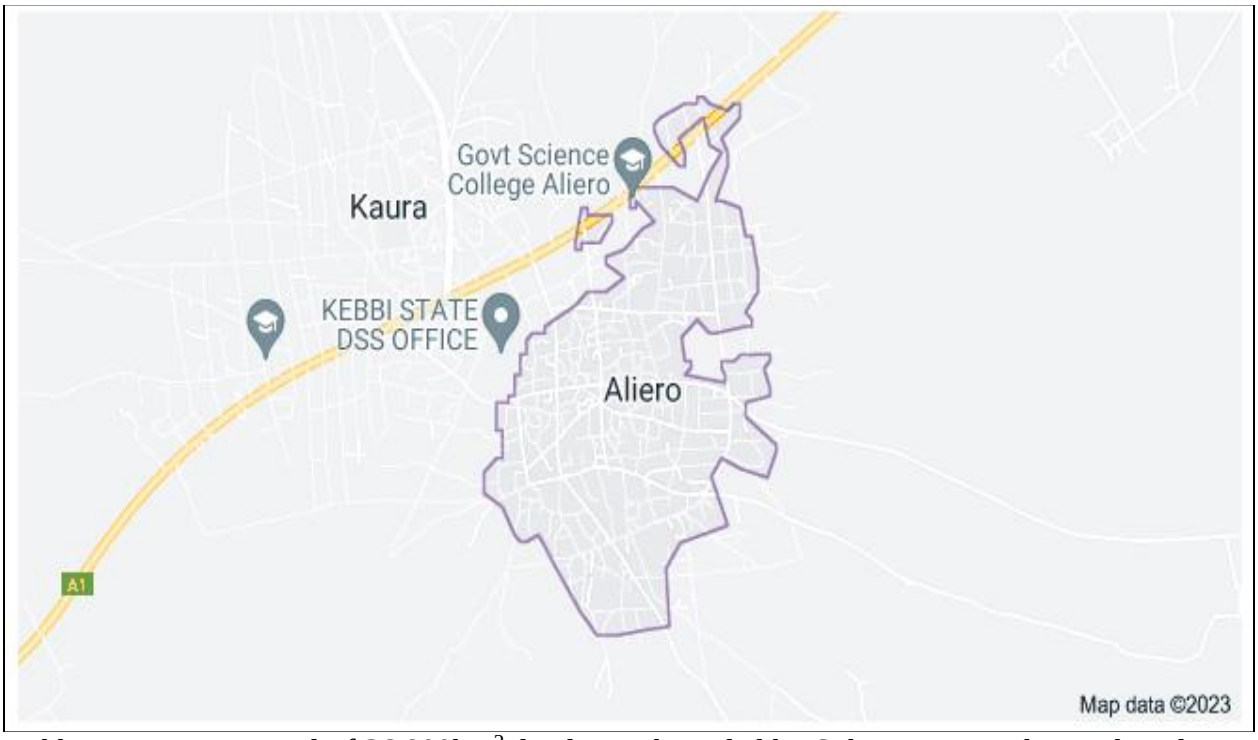
The *Ziziphus* species are distributed throughout the tropical, subtropical and temperate regions of both the hemispheres (Rendle, 1959). Small or large plantations of ber exist in Afghanistan, Iran, Syria, Burma, Australia (Nijjar, 1975), France (Evreinoff, 1949; Munier, 1973), the United States of America (Thomas, 1924; Lanham, 1926; Riley, 1970) and the Russia (Mukherjee, 1967). Ber fruit is a drupe, globose to ovoid in shape, up to 6 x 4 cm in size; skin smooth or rough, glossy, thin but tough, yellowish to reddish or blackish; flesh white, crisp, and juicy, sub acid to sweet, becoming mealy in fully ripe fruit. Irregular furrowed stones are found in tuberculate seed which contains 6 mm long brown kernels of elliptic shape. Ber fruit is generally eaten fresh and is a rich source of ascorbic acid, essential minerals and carbohydrates (Pareek, 1983; Abbas *et al.*, 1997; Pareek*et al.*, 2002). Colour of fruit is changed from green to yellow to chocolate brown with the maturity and ripening. Jujube (*Zizyphusj ujuba Mill*.) is cultivated from ancient time in China and as reported by Pareek*et al.*, (1983), it's cultivated for the last 5000 years.

Chinese jujube is found in subtropics of Asia and largely in China. Sixty quintals of fruits were produced from 30,000 ha area in 2009 in China (Cui, 2009). China alone contributed 90% of world production of jujube (Li *et al.*, 2005; Su and Liu, 2005). 'Chinese Winter Jujube', a new jujube cultivar, is known as "the king of jujube in China". This cultivar characterized with thin peel, crisp flesh and rich in nutritional components (Sun *et al.*, 2007). Jujube fruit contains flavonoids, vitamins, amino acids, organic acids, polysaccharides, and microelements (*Li et al.*, 2007) and found useful in spleen diseases and nourishment of blood in Chinese system of medicine (Shen*et al.*, 2009).
The main objective of the study is to assess the effect of different presowing treatment methods on *ziziphus mauritiana.* seeds germination and seedling growth performance.

MATERIALS AND METHODS

Study Area

The study was conducted at faculty of Agriculture trees seedling nursery of the University of Science and Technology Aleiro (KSUSTA), The study area is located between latitude 12° 06'. 89" N and longitude 4° 11'. 80" E (Google earth, 2019).



Kebbi state cover a total of 36,800km^2 land area, bounded by Sokoto state to the north and east, Niger state to the south and Benin republic to the west. The state enjoy a tropical continental type of climate and this is largely controlled by two air masses, namely tropical maritime and tropical, blowing from the Atlantic and Sahara desert respectively, this air masses determine the two dominant seasons wet and dry, the wet season last from April to October in the south and May to September in the north, while the dry season lasts for the remaining period of the year. Mean annual rainfall is about 800mm in the north and 1000m in the south. Temperature is generally high with mean annual temperature of about 26˚C in all locations. However, during the Harmattan season (December to February) the temperature can go down to about 21˚C and up to 40˚C during the months of April and June. Night temperatures are generally lower with low relative humidity for most of the year except during the wet season when it reaches an average of eighty percent's. This explains the hot dry environment which is in sharp contrast to a hot humid environment in the southern parts of Nigeria .The natural vegetation of the state varies, in the extreme north, Sahel shrubs are found, the central part has savannah type of vegetation while the southern part is covered with tick shrubs and jungles.(Google earth,2019)

Kebbi state was created out of the former Sokoto state on 17 August 1991. The state has a total population of 3,137,989 people as projected from the census, within 21 local government area (Google earth, 2019).

Materials

The materials that were used are;

1. *Z. mauritiana.* Seeds
2. Water for watering.
3. Cold water, hot water, sand paper, H_2SO_4
4. Measuring tape for to measure plant height.

5. Watering can, $\frac{\text{Germinated seed}}{\text{Total Seed sown}} \times 100$ for watering seedlings.
6. Note book for data record.
7. Vanier caliper to measure colar diameters.

Description of treatment

The experimental treatments were laid out in the field using Randomize Complete Block Design (RCBD) with six replicates. The treatments are; cold water (T1), hot water (T2), sand paper (T3), H_2SO_4 (T4), concentrates Hcl (T5) and control (T6). Each treatment was replicated six times to determine their effect on seed germination and early growth performance. The treatment combination was as follows:

Treatment	Replications					
T1	T1R1	T1R2	T1R3	T1R4	T1R5	T1R6
T2	T2R1	T2R2	T2R3	T2R4	T2R5	T2R6
T3	T3R1	T3R2	T3R3	T3R4	T3R5	T3R6
T4	T4R1	T4R2	T4R3	T4R4	T4R5	T4R6
T5	T5R1	T5R2	T5R3	T5R4	T5R5	T5R6
T6	T6R1	T6R2	T6R3	T6R4	T6R5	T6R6

Methodology

Control treatment (T1), the seeds were directly sowed in to the polythene bags without any treatment; Cold water (T2), the seed was soak in cold water of 4^oc for 12 hours; treatment 3 (T3), the water was boiled for 15 minutes and the seed was soak in the hot water for further 15 minutes; scarification (T4), the seed of *Z. mauritiana* was scarified on both sides to encourage the seeds to imbibed water; Concentrate H_2 SO_4 (95%) treatment (T5) and concentrate Hcl (95%) treatment (T6), the seeds were soaked for 10 minutes in the H_2SO_4 and HCL respectively and the seeds were washed with plenty water for further 10 minutes before planting in to the polythene bags.

Data Collection

The data was collected basically on the following parameters; the germination percentage, plant height, colar diameter and number of leaves.

Germination percentage was calculated using the following formula:
Germination %=

(Keshavarzi*et al.,* 2011)

Growth parameters measurement was taking fortnightly in the morning after sowing for a period of eighth (8) weeks. Plant height was measured using centimeter ruler, number of leaves was counted physically, colar diameter was determined using Vanier caliper.

Data Analysis

Data collected was subjected to Analysis of variance (ANOVA) using SAS. Least significant Difference (LSD) was used to separate the mean value where significance different exist among the treatment mean.

RESULT PRESENTATION

Germination is the process by which an organism grows from a seed or spore. The term is applied to the sprouting of a seedling from a seed of angiosperm or gymnosperm, the growth of a spore

ling from a spore, such as the spore in fungi ferns, bacteria, and growth of pollen tube from the pollen grain of a seed plant.Bareke, (2018).
Actual germination is said to have occurred when the radicle has elongated by far beyond seed coat giving indications that the seeds will develop into healthy seedlings.

Germination
The result of *Ziziphusmauritiana*seed germination is presented in figure 1. Untreated seed presented germination (66.6%) followed by scarification (61.1%), cold water (50%), H_2S0_4 and HCL with determination percentages of 22.2% each while hot water had the lower germination of 16.%.

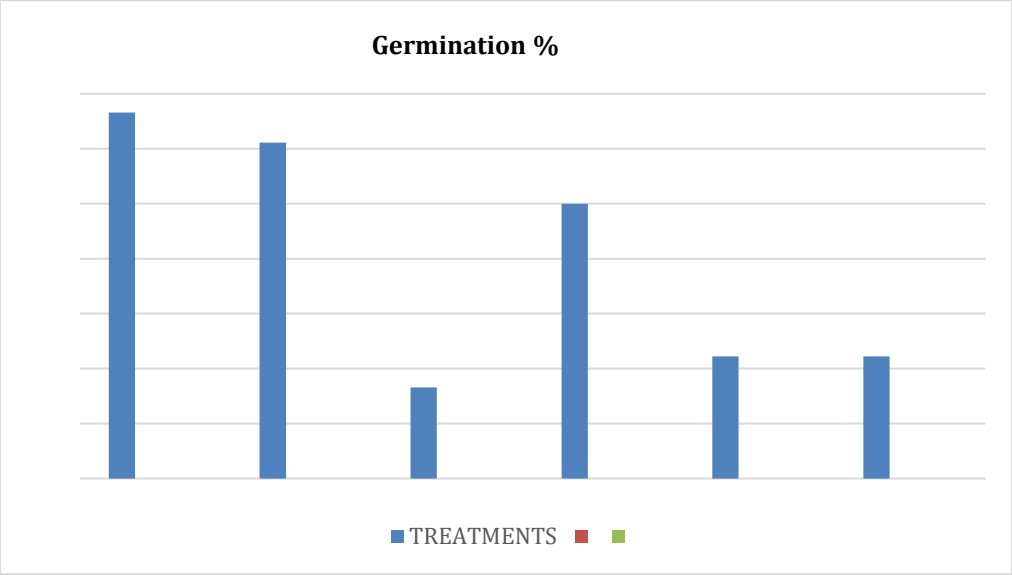


Fig 1: Effect of pre-sowing treatments on seed germination of *Ziziphus mauritiana.*

The Figure above shows the effect of treatment on the germination of *Ziziphus mauritiana.* The seed that was not treated (control) recorded the highest germination percentage (66.6%) followed by scarification (61.1%) then hot water (50%), cold water (16.6%)

Early Growth Performance
The effect of pre-sowing treatments on plant height, colar diameter, number of leaves is presented in table 4.1.There was no significant difference ($P>0.05$) between treatments on plant height. Treatment 2 had high seedling height (9.83cm) followed by treatment 4 (9.13cm) and treatment 5 recorded the least seedling height (4.83cm). There was significant ($P<0.05$) effects between treatments on colar diameter in which plant treated with scarification recorded the highest mean value (2.56mm) which is statistically similar ($P>0.05$) with cold water but significantly differed ($P<0.05$) with HCl (0.73mm), hot water (0.70mm) and sulphuric acid (0.55mm). Similarly the number of leaves per plant was significant ($P<0.05$) where untreated seeds recorded the heights number of leaves per plant (11.66) followed by cold water (8.06), scarification (6.66), HCl (4.33) and the least number of leaves per plant was recorded in the hot water (4.21) and sulphuric acid (3.00).

Table 4.1 Effect Of Different Pre-Sowing Treatment of Plant Height, Colar Diameter, Number Of Leaves of *Z. mauritiana* in Aliero local government

Treatment	Plant height (cm)	Colar diameter (mm)	Numbers of leaves per plant
Control	7.83	1.86^{ab}	11.66^{a}
Scarification	9.80	2.56^{a}	6.66^{ab}
Hot water	5.33	0.70^{c}	4.21^{b}
Cold water	9.13	2.36^{a}	8.06^{ab}
Sulphuric acid	4.83	0.55^{c}	3.00^{b}
HCl	7.21	0.73^{b}	4.33^{ab}
LSD (0.05%)	10.12	1.143	7.401

Means followed by different letters (a,b,c) in the same culum are statistically different at (0.05%); cm=centimeter.

DISCUSSION

The results from the study showed significant effect in germination percentage where untreated seeds (control) and scarified seeds, recorded the highest germination percentage. This research disagrees with Sodimu *et al.* (2020) where they observed the lowest germination in the untreated seed (control) of *Z. mauritiana*, however the result agreed with Singh *et al.* (2018) whose found that scarification significantly enhanced seed germination in *Z. mauritiana* by breaking the seed coat dormancy, soaking the seeds in water or nutrient solutions before sowing has also been shown to improve germination rates and early growth performance according to Kumar *et al.* (2016).

Additionally, stratification, which involves subjecting the seeds to a period of cold or moist conditions, has been found to promote germination in *Z. mauritiana.* (Jain et al. 2014).The research also conformed with Abdol Hussein *et al. (*2012) where they obtained the highest germination percentage in one week with scarification treatment. Furthermore the result is in agrees with Kumar et al.(2019) whose found that scarification positively influence seed germination and early growth performance on *Z. mauritiana.*

Overall, these studies suggest that different pre-sowing treatments can significantly impact Z. *mauritiana.* seed germination and early growth performance. However, it's important to note that the effectiveness of these treatments may vary depending on factors such as seed source, environmental conditions, and specific treatment protocols used as reported by Olatunji *et al,* (2012).

Conclusion

Based on the results of this study, it can be concluded that different pre-sowing treatments had significantly impact *Ziziphus mauritiana* seed germination and early growth performance.

Untreated seed and scarification treatments produce the best results in germination and early seedling growth performance.

Recommendation

The following recommendations are made:

1. Seedlings of *Ziziphus Mauritiana.* are best raised without any pre sowing treatment
2. Scarification should be used to produce best early seedling growth performance
3. Further research should be conducted to explore the used of other pre-sowing treatments on *Ziziphus mauritiana* seed germination and early growth performance.

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