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Breaking Seed Dormancy in Tamarind *(Tamarindus Indica)* A Case Study of Gombe Local Government Area

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Key words; Dormancy, Tamarind, Scientific name; *Tamarindus indica*, Hausa name; *Tsamiya*, Fulfulde name; *Jabbe*, Family; Leguminosae

ABSTRACT: The study was carried out to investigate the effects of sulphuric acid and hot water treatments on the germination of Tamarind (*Tamarindus indica*). Seeds were sown in poly pots under normal environmental condition for germination. Thirty (30) seeds of *T. indica* (one seed per pot) with ten replicates each were used. The highest germination percentage was recorded in seeds treated with fifty (50%) percent sulphuric acid concentration within sixty (60) minutes soaking period. Germination was observed to be enhanced by the effect of sulphuric acid on disrupting the seed coats of Tamarind (*Jabbe*), followed by hot water. Results of this research may serve as useful information in the production and improvement of the tree species, as knowledge on seed germination requirements is a critical factor in seedlings production.© JASEM

Seed dormancy could be considered simply as a block to the completion of germination of an intact viable seed under favourable condition. (Finch-Savage and Leubner-Metzger, 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 favourable for its 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
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A diverse range of dormancy mechanisms (blocks) has evolved in keeping within the diversity of climates and habitats in which they operate. The five classes of dormancy are: physiological, morphological, morpho-physiological, physical and combinational dormancy.

Tamarind is native to tropical Africa, the tree grows wild throughout the Sudan and was long ago introduced into and adopted to India that it has often been reported as indigenous there also, and it was apparently from this Asiatic country that it reached the Persians and the Arabs who called it "*tamar hindi*" (Indian date, from the date-like appearance of the dried pulp), giving rise to both its common and generic names. Unfortunately, the specific name "*indica*", also perpetuates the illusion of Indian origin. The fruit was well known to the ancient Egyptians and the Greeks in the 4^{th} century BC.

There are types of tamarinds that are sweeter than most. One in Thailand is known as "*Makham waan*". One distributed by the United State Department of Agriculture's Subtropical Horticulture Research Unit, Miami is known as "Manila sweet". The name "tamarind" with a qualifying adjective is often applied to other members of the family Leguminosae having somewhat similar foliage.
The tree tolerates a great diversity of soil types, from deep alluvial soil to rocky land and porous, oolitic limestone. It withstands salt spray and can be planted fairly close to the seashore.

Studies revealed that the fruits begin to dehydrate 203days after fruit-set, losing approximately half moisture up to the stage of full ripeness, about 245days from fruit-set. The dormancy in tamarind should just be associated with the absence of germination; rather it is the characteristic of the seed that determines the conditions required for germination.

Very little research has been carried out on the effectiveness of hot water treatment and effects of sulphuric acid on the germination of seeds. This research will progressively work on the methods of breaking seed dormancy in *T.indica*. Even though,

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significant differences exist between species, the aspect of germination and dormancy breaking can help in replacements of ageing species that are gradually dying.

Aim is to determine reliable and efficient treatments i.e., physical or chemical that can weaken the seed coat of *T.indica*, with the following objectives;
To identify the various method (treatments) of breaking seed dormancy that can significantly influence the germination of *T.indica*.
To enhance rapid sustainable production of *T.indica*.

MATERIALS AND METHOD

Of all the trees of the tropics, none is more widely distributed or more appreciated as an ornamental than the tamarind of the family Leguminosae. The seeds of this ageing tree do not germinate on their own accord and are rarely seed growing in the wild, even though the conditions of water, oxygen, and temperature are suitable. Experiment was conducted in the Botanical Garden, Biological Sciences Department, Gombe State University. The materials used include; Tamarind seeds, Sulphuric acid, Distilled water, Thermometer, Beakers, Petri dishes, Poly pots and Centimetre ruler. Good viable seeds of tamarind were subjected to two different methods of breaking seed dormancy, these methods are; Sulphuric acid of 50% concentration and Hot water of 100°C.The type of soil used was a well drained loamy soil.

The seeds of *Tamarindus indica* were collected using a random sampling technique (RST) from four (4) different locations of Gombe Local Government Area, which are; Tudun wada, Pantami, Nassarawo, and Shango Housing Estate. After dehuling the fruits, equal samples of seeds were combined to give one bulk population sample from which sub-samples were taken for germination test. Sample of ten (10) seeds were taken for each treatment method (hot water and sulphuric acid), and untreated (control), which gives a total number of 30 sample seeds for the research.

Fig I: Bulk population sample of *T.indica* seed
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Ten (10) samples of seeds were treated with sulphuric acid contained in a beaker. The seeds were put in the sulphuric acid having a concentration of fifty percent (50%) for a period of sixty minutes (60mins) as treatment time. The seeds were rinsed thoroughly in clean distilled water after which they were removed from the beaker, and tested for germination.

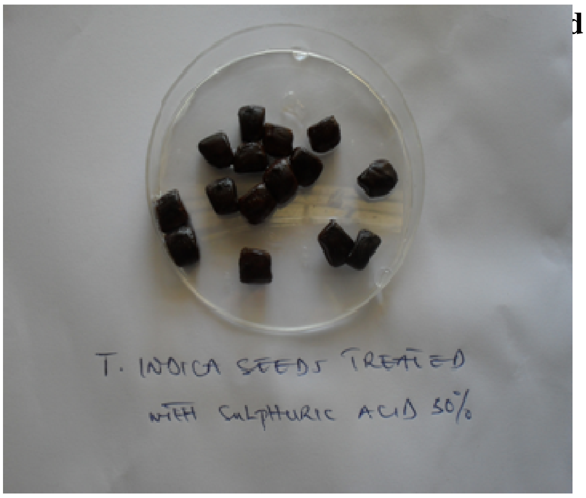

Fig. II *T.indica* seeds treated with Sulphuric acid of 50% concentration.

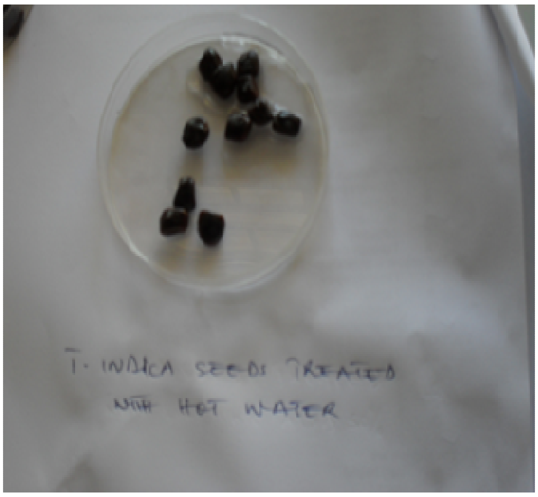

Fig.III *T.indica* seeds treated with hot water.

The hot water effect was carried out when tamarind seeds were put in beaker containing boiled water of 100°C for a period of thirty minutes (30mins), after which the seeds were tested for germination.

The germination percentage for each seed batch (10 replications of each 3 treatments) was taken for a period of fifteen (15) days after sowing. Also the mean height of the plant was taken on daily basis after the emergence of seedlings using a centimetre ruler, and the average number of leaves was also taken at the intervals of five (5) days after the seedlings germinate.

Undamaged and disease free seeds were selected for sowing, after they have been treated with sulphuric acid and hot water, the seeds were then sown in poly pots. The sowing depth was two (2) centimetres deep for all the replications in each row.

The data was subjected to analysis of variance (ANOVA) after observation for a period of fifteen (15) days after sowing in order to know the difference between the treatments, mean separation was done using the Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

All the seeds (viable) which have overcome dormancy either naturally or artificially will readily germinate under suitable environmental conditions necessary for seed germination i.e., water, oxygen, and some cases light. In most cases these seeds germinate if placed on moist substrate.

Fig IV. Germinated samples of *T.indica* plant

The germination percentage of tamarind (*Tsamiya)* treated with different artificial methods of breaking seeds dormancy were obtained from the data collected for a period of fifteen (15) days. The result clearly shows that seeds of tamarind treated with sulphuric acid of 50% concentration gave a percentage germination of 100%, followed by hot water (100°C) treatment which gave 80% in fifteen (15) days after sowing. Lastly the untreated seeds (control) gave 50% in fifteen days after sowing.

Growth in a plant is the outcome of cell division, enlargement of the new cells and their differentiation into different types of tissues. These process of growth are accompanied by a permanent change in size (usually increase in the dry weight of the growing parts).

The simpler rather crude method of measurement of growth (direct method) was used during the data collection, in which the length of growing part (shoot) was measured just with the help of centimetre ruler daily after the seedling emergence.

Table 1. Table showing Average Seedling height (cm)

S/No	Treatments	Average plant height
1	Control	1.9cm
2	Sulphuric acid 50%	6.8cm
3	Hot water (100°C)	2.9cm

Also the direct method was used to count the number of leaves during data collection at the intervals of five (5) days after the young seedling emerged. The table below shows the average leaves number of the young tamarind (*Jabbe)* seedlings that were subjected to different methods of breaking dormancy.

Table 2.Showing Average leaf number

S/No	Treatments	Average leaf number
1	Control	3
2	Sulphuric acid 50%	5
3	Hot water (100°C)	3

Table 3 ANOVAs Table showing the significant differences observed

S V	Dff	SS	MS	Fcal	Ftab
Treatments	2	144.12	72.06	33.36	3.49
Error	20	43.1	2.16		
Total	22				

KEY: α = 0.5 (5%), Coefficient of variation (CV) = 13.7%, DFF=degree of freedom, SS=Sum of Squares, MS= Mean separation, Fcal=F value calculated and Ftab=F value tabulated.

The treatments showed significant differences since the computed F value is greater than the tabular F at 0.5 (5%) level of significance.

Table IV: Duncan's table showing homogeneity within the treatments

Cause	N	1	2
2	10	7.800	
3	8		12.75
1	5		13.00
significance		1.00	0.75

KEY: Subset for alpha = 0.05, N=Number of replicates, 1=Sulphuric acid treatment, 2=Hot water treatment

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" at least until the next favourable growth period. Some seeds can remain dormant and yet viable with embryo in a state of suspended animation for hundreds of years.

The seed coat apparently plays a major role in maintaining dormancy. In some species, that seed coat seems to act primarily as a mechanical barrier, preventing the entry of water and gases, without which growth is not possible. In these cases, growth is initiated by the seed coat's being worn away in various ways-such as being washed by rainfall, abraded by sand, burned away in a forest fire, pre-treating with chemicals and growth regulators, or other animals. In other species, dormancy seems to be maintained chiefly by chemicals inhibitors in the seed coat. These inhibitors undergo chemical changes in response to various environmental factors such as light or prolonged cold or a sudden rise in temperature, neutralize their effects, or they may be washed or eroded away. Eventually, the embryo resumes growth (Cutis and Barnes, 1983).

The result of the experiment revealed that soaking of *T.indica* seeds in hot water at 100°C for 30minutes had a percentage germination of 20% at the period of eleven (11) days after sowing. A similar result was obtained by Muhammad and Amusa (2003). At fifteen (15) days after sowing, the germination percentage was 80%. The germination percentage was also found to be 50% for seeds that received no any pre-treatment before sowing. This also corresponds to the finding on "Effect of some seed pre-treatment on emergence of *Acacia senegal and Tamarindus indica*" (Saikou et.al. 2008). Germination percentage was also highest when *Tamarindus indica* seeds were soaked in 50% sulphuric acid concentration for a period of 60minutes. Treatment time exerted a significant effect on seed germination. Muhammad and Amusa (2003) reported a similar result of 98% germination when tamarind *(Jabbe)* seeds were treated with 50% sulphuric acid for 60minutes.

The pre-germination treatment employed are designed to soften, puncture, wear away or split the seed coat in order to access the embryo for germination, the use of acid treatments could be termed the chemical method of scarification to raise germination in savannah tree seeds. This method was found to improve germination in both tropical and savannah tree seeds. Sulphuric acid treatment has been found to be effective for several tropical species such as *Acacia sp,* Parkia sp, Tamarind, *Cassia siemea and Terminalia sp* (Agboola, 1991). It was also shown that from the experiment a germination percentage of 40% was obtained after a seven (7) days period of sowing, and 100% after fifteen (15) days. A similar result was obtained by Awodola

(1994) that germination percentage in seeds of *Tamarindus indica* was significantly enhanced by 50% sulphuric acid at 60minutes soaking period

Result also indicated that seed germination occurs as a result of seed coat rapture due to pre-treating of *Tamarindus indica* seeds with hot water and sulphuric acid prior to the soaking period. Wang *et al* (2007) pointed out that most pre-treatment significantly reduce hard seed content and improve germination percentage and rate of growth. This also shows that from the experiment, seeds of tamarind (*Tsamiya*) treated with sulphuric acid and hot water gave a highest percentage of germination compared to untreated (control) seeds, and also showed to have an average height of 6.8cm (**Table I**) and five (5) leaves (**Table II**) respectively for sulphuric acid treated seeds. An average height of 2.9cm (**Table I)** and three (3) leaves (**Table III)** was found for seeds of tamarind treated with hot water, the untreated seeds gave an average height of 1.9cm (**Table I**) and two (2) leaves (**Table I**) respectively.

When the germination count was taken for a period of fifteen (15) days after sowing, the seed treated with sulphuric acid of 50% concentration performed much better in disrupting the hard seed coat of tamarind seeds than the other seeds treated with hot water and control seeds. So by this experiment, we observed that sulphuric acid treatment have effect on emergence of tamarind seeds.

From the above, one can infer that dormancy of seeds of *Tamarindus indica* was probably associated with the seeds coat, since the treatment that induced germination were those that can effect disruption of the hard seed coat.

REFERENCE:

Agbola. D.A, Etejere, E.O (1991). Studies on seed dormancy of selected economic tropical forest species. Nigerian journal of Botany, vol.4: 115-125.

Awodola, A.M (1994). Aspects of germination in seeds of African locust bean tree *Parkia biglobosa* Don. J Tropical Forest Resource. 10: 82-91.

Baskin, C and Baskin, J (2004). Seed dormancy and how is related to germination. Retrieved from http://www.seedbilogy.com/seed/ac.

Curtis, H. and Barnes, N.S (1983). Invitation to Biology, third edition. Worth publication, INC. New York, USA.

Finch-Savage and Leubner-Metzger (2006). Seed dormancy. Retrieved from http://www.ehow.com

Muhammad, S and Amusa, N.A (2003). Effects of sulphuric acid and hot water treatment on seed germination of tamarind. African journal of Biotechnology, vol. 2. pp 276-279.

Saikou, E.S, Kabura, B.H, and Wen-chi, H. (2008). Effect of some seed pre-treatments on emergence of *Acacia senegal.* World journal of Agricultural Science vol. 4(2). 213-219.

Wang, Y.R., Hanson, J., Mariam, Y.W. (2007). Effect of sulphuric acid pre-treatment on breaking hard seed dormancy in diverse accessions of five wild Vigna species. Retrieved from, http://www.ingentaconnect.com.