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An Investigation into Breaking Seed Dormancy (Tamanrindus indica) in Akko Local Government Area, of Gombe State Nigeria

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Abstract: *This research was conducted in order to investigate the effects of sulphuric acid and hot water treatments on germination of Tamarind (Tamarindusindica). Firstly the seeds were sown in poly pots and were exposed to normal environmental conditions for germination. Of all, thirty seeds were planted in such a way that there are each seed per a pot with ten replicates used for each. At the end of if all, the highest germination percentage was recorded in the seeds treated with 50% sulphuric acid concentration under sixty minutes of soaking period. In this case, germination was observed to be enhanced by the effect of sulphuric acid as a result of disrupting the seed coats as well as the usage of hot water. Also to serve as recommendation, the result of the experiment could be used for the production and improvement of the tree species as well as to serve as knowledge on seed germination requirements or as critical factors in seedling productions.*

Keywords: *Seed, dormancy, sulphuric acid and germination*

1. Introduction

Ordinarily, seed dormancy may bedescribed as a block which may hinder the completion of an intact viable seed under favourable condition (Finch and Leubner, 2006). A seed which is said to be dormant does not normally have the capacity to germinate within a specified time under any condition, such as physical environmental factors which are optimal for its germination that is after the seed become non-dormant (Baskin and Baskin, 2004). Also any seed which germinate over the widest range of normal physical environmental factors possible for the genotype is

said to be completely non-dormant.

A dormancy is a block to germination which has taken place in a different manner across species as a result of adaptation based on dominant environmental factor, in such a way that germination occur in only conditions for establishing a new plant generation is likely suitable (Finch and Leubner, 2006). Different range of dormancy devices has progressed in keeping with the change of climates and habitat in which they function.

Dormancy may also be considered as any environment which modifies the conditions needed for germination. Also by extension, when seed does no longer requires specific environmental signals it is said not to be dormant (Baskin and Baskin, 2004).

Dormancy is a seed characteristic which defines the conditions requires for germination and therefore any one that widens the environmental requirement for germination should be regarded dormancy release factors. A wide range of factor can therefore alters germination (physiological) seed dormancy, e.g. temperature, light, nitrate or naturally occurring chemical signals in leach are from litter that cover the seeds in their habitat. However, there is an important distinction in the seed response to these factors. There are factors that are related to slow seasonal change, these factors (e.g temperature) are integrated overtime to alter the depth of dormancy, the sensitivity to other factors that indicate in a more immediate way that condition are suitable for germination (e.g ljght), which could be considered to terminate dormancy and thereby induce germination. Each of these factors therefore remove successive blocks to germination, but this processes usually need to be carried out in a set order for it to work i.e, in the process described, light must come last to be effective (Finch and Leubner, 2006).

1.1. Statement of the Problem

Even with the experience and exploitation human had on T.indica as a wild form, yet the plants are gradually dying without replacements and the seeds do not germinate, possibly due to lack of factors required to break the dormancy. There is therefore, the need to understand the cultural requirement of the species, knowledge on seed germination is known to be important for any success in afforestation. In view of that, this research is designed to mainly determine the effect of hot water and sulphuric acid treatment on the germination of T. indica.

1.2. Justification of the Study

Little research has been carried out on the effectiveness of hot water treatment and effects of sulphuric acid on germination of seeds. This research will therefore gradually work on the methods of breaking seed dormancy in T.indica. Although, significant variations may occur between species, the aspect of germination and dormancy breaking can assist towards the replacements of ageing species that are progressively dying.

1.3. Scope of the Study

The research seek to investigate different methods used by scientists and technologist in order to break the dormancy of seeds, as well as to prove which of the treatment can more importantly influence germination of T. indica.

1.4. The Research Gap

Even though, numerous studies and research works were conducted globally in places such as Africa, Asia, Arab world and America just to mention few but however, this particular research is peculiar compared to those carried out in places mentioned above because it was conducted in Sahel savannah which is at the extreme end of Guinea Savannah. This makes it important compared to other places, because of the differences in terms of geographical location, weather condition, pressure as well as other unforeseen factors which might influence the result of an experiment. This research tries to break dormancy of Tamarindusindica seed in order to compare it with what is obtained in other places of the world where such investigation were conducted.

1.5. Objective of the Study

(i)To determine which treatment can best influence the germination of T. indica

(ii)To enhance rapid sustainable production of the specie in question

(iii) To identify various method of breaking seed dormancy in T. indica.

(iv)To determine any treatment i.e physical or chemical that can weaken the seed coat of the specie

2. Materials and Methodology

2.1. Experimental Site

This experiment was carried out in the Botanical garden of Biology department, Federal College of Education (technical) Gombe.

2.2. Materials used for the Experiment

- Tamarind seeds
- Sulphuric acid
- Distilled water
- Thermometer
- Beakers
- Petri dishes
- Poly pots and
- Centimetre rule

2.3. Experimental Setup and soil Preparation

Good viable seeds of tamarind were subjected to two methods of breaking seed dormancy which are:

- Sulphuric acid of 50% concentration and
- Hot water of 100%

The type of the soil used for this experiment was a well-drained loamy soil

2.4. Sample Collection

The samples were collected using a random sampling technique (RST) from four different location of Akko Local Government Area namely: Tumfure, Akko, Kumo and Gona. After dehuling the fruits, equal samples of seeds were combined to give one bulk population from which sub samples were taken for germination test. Sample of ten seeds were taken for each treatment method (hot water and sulphuric acid) and un treated (control), which gives a total number of 30 sample seeds for the research.

Figure 1: A bulk population sample of Tamarindusindica seed.

2.5. Viability Test

After collecting and dehuling the fruits, the seeds were put in a beaker containing distilled water. A few number of tamarind seeds that floated on the distilled water proved to be non-viable and were removed out of the sample. Those that sunk (seeds) were sampled and tested for germination in poly pots (one seed per pot) and ten replication for each treatment method.

2.6. Sample Treatment

Sub-sample of seeds used in this research that were taken from bulk population of sample, which were treated with diluted sulphuric acid of 50% concentration and hot water as first and second treatment respectively, and on different time effect.

2.7. Sulphuric Acid Treatment

Ten samples of seeds were treated with sulphuric acid contained in a beaker. The seeds were put in the sulphuric acid having a concentration of 50% for a period of sixty minutes as treatment time, the seeds were rinsed thoroughly in a clean removed from the beaker, and tested for germination.

T.indica**seeds Treated with Sulphuric Acid 50%**

Figure 2: Seeds treated with sulphuric acid of 50% concentration

2.8. Hot Water Treatment

The hot water effect was carried out when tamarind seeds were put in beaker containing boiled water of 100 degree centigrade for a period of thirty minutes after which the seeds where tested for germination.

T. indica**SEEDS TREATED WITH HOT WATER**

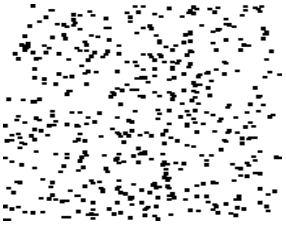


Figure 3: Seeds treated with hot water.

2.9. Experimental Layout Design

For the purpose of this research, completely randomized design (CRD) method with ten replication each for the two treatments and controls. The germination percentage for each seed batch (10 replication of each 3 treatment) was taken for a period of fifteen days after sowing. Also the main 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 days after the seedlings germinate.

2.10. Sowing and seed Treatment

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 centimetres deep for all the replication in each raw.

2.11. Significance Difference Determination (Data Analysis)

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

3. Results

3.1. Germination Percentage

The germination percentage of tamarind treated with different artificial methods of breaking

seeds dormancy were obtained from the data collected for a period of fifteen days. The results clearly shows that seeds of tamarind treated with sulphuric acid of 50% concentration gave a percentage germination of 100% followed by hot water (100 degree centigrade) treatment which gave 80% in fifteen days after sowing. Lastly the untreated seeds (control) gave 50% in fifteen days after sowing.

3.2. Growth Rate

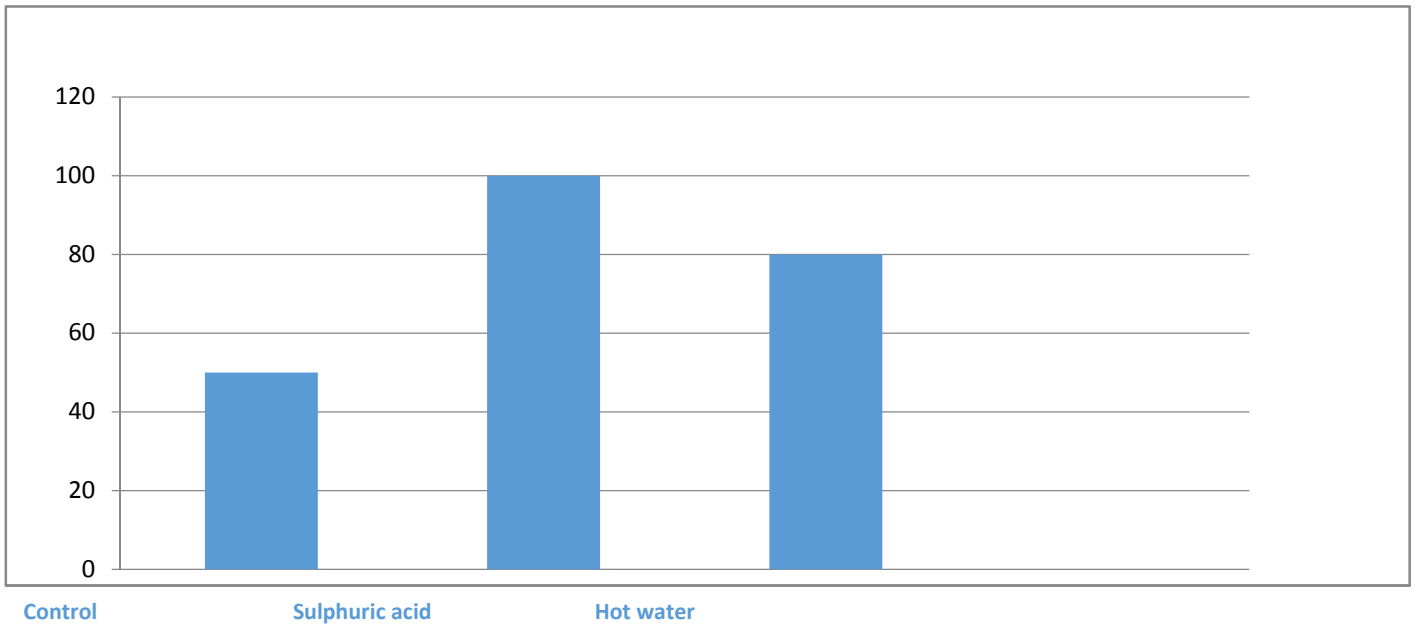


Figure 4: Germination percentage in 15 days of Tamarindusindicaseeds subjected to different treatment.

Growth in 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).

3.3. Average Plant Weight

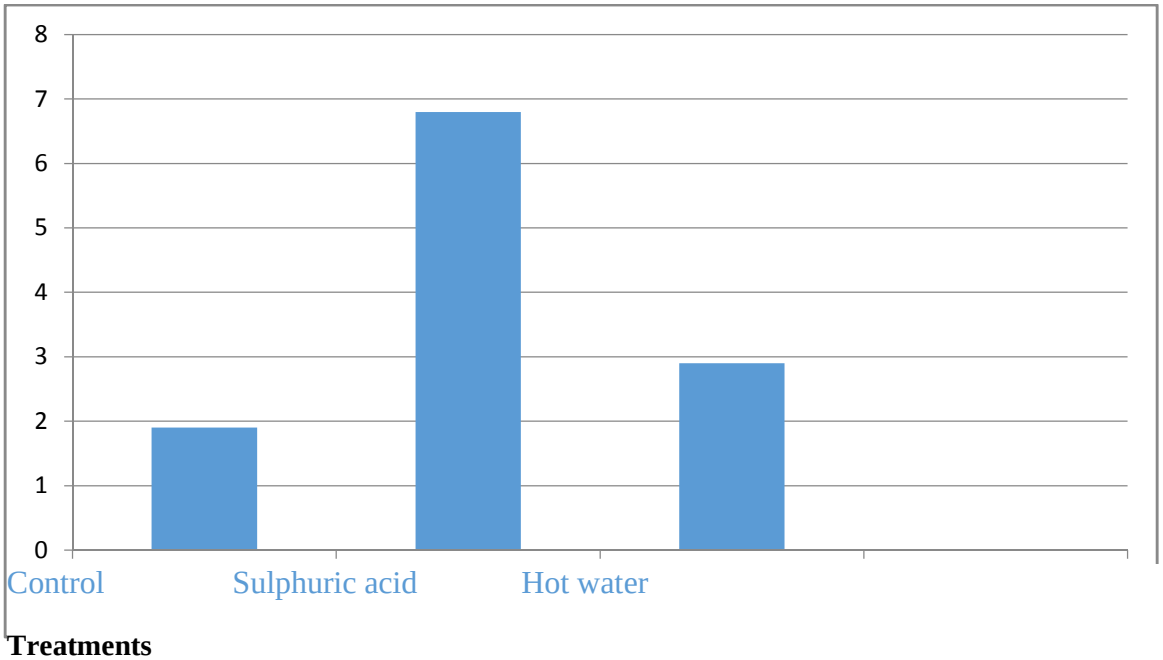
The simpler rather crude method of measurement of growth (direct method) was used during data collection, in which the length of growing part (shoot) was measured just with the help of centimetre ruler daily after the seedling emergence.

Table 1. AVERAGE SEEDLING HEIGHT

S/NO	TREATMENT	AVERAGE PLANT HEIGHT
1	Control	1.9cm

2	Sulphuric acid 50%	6.8cm
3	Hot water (100^{oC})	2.9cm

Figure5. AVERAGE SEEDLING HEIGHT



3.4. Average Leaves Number

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

Table 2: AVERAGE LEAF NUMBER

S/NO	TREATMENTS	AVERAGE PLANT HEIGHT
1	Control	3

2	Sulphuric acid 50%	5
3	Hot water (100^{oC})	3

3.5. Analysis of Variance Significance Difference Determination

Analysis of variance is useful technique for comparism of means of several groups. The data collected during observation was subjected to analysis of variance in order to know the significance difference between the treatments employed in this research, and also the reliability percentage of the research was calculated following the coefficient of variation. Mean separation between the treatments was done using Duncan's Multiple Range Test (DMRT)

Table 3: ANOVA TABLE OF SIGNIFICANCE DIFFERENCE OBSERVED

SV	DFF	SS	MS	Fcal	Ftab
TREATMENTS	2	144.12	72.06	33.36	3.49
ERRORS	20	43.1	2.16		
TOTAL	22				

KEYS: a = 0.5 (5%), coefficient of variation (CV) = 13.7%, DFF = degree of freedom, SS = Sum of squares, MS = means separation. The treatments showed significant difference since the computed F value is greater than the tabular F at 0.5 (5%) level of significance.

Table 4: DUNCAN'S TABLE OF 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

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

4. Discussion

The results obtained of the experiment has indicated that soaking of tamarind seeds in hot water at 100^{oC} for 30 minutes had percentage germination of 20% at the period of eleven days after being planted, which agreed with the work of Muhammad and Amusa (2003). At fifteen days, it gave 80%. While the result obtained with seeds which had not undergone any treatment before planting was only 50%. Germination percentage of Tamarindindicaalso yielded the highest result of 100%, when it was soaked with 50% sulphuric acid for a period of sixty minutes. However there was variation in germination as a result of changes made based on the duration the seeds were subjected to treatment. For example, (ibid), obtained the result of 98% with the seeds of tamarind (jabbe) when subjected to 50% sulphuric acid treatment for a period of 60 minutes.

All the above actions were taken in order to soften the seed coat so that it can easily have access to embryo for germination. For example, the use of chemical was found to improve germination in both tropical and savannah plant seeds. Sulphuric treatment was discovered to be highly good for many tropical plant species especially, Acaciaspp, parkia spp and tamarind etc. (Agbola, 1991). The experiment has also realised a germination percentage of 40% after seven days as well as 100% after fifteen days which coincided with the work (Awodola, 1994) which suggested that germination percentage in seeds of Tamarindus indica was greatly improved with 50% sulphuric acid treatment after sixty minutes.

In another development, it was also discovered that the germination take place as a result of the seeds being subjected to treatment with hot water and sulphuric acid, which causes coat rapture as in the case of Tamarindusindica. Also according to Wangel et, at (2007), most pre-treatment drastically reduce hard seed content which help germination percentage and growth rate.This simply proves the fact thatseeds treated with sulphuric acid and hot water gave the highest percentage germination when compared with untreated (control) seeds. This has also proved to have an average height of 6.8 cm as seen in table one and five leaves which is also in table five as in the case of seeds treated with sulphuric acids. Also in another development an average height of 2.9 cm as shown in table one and three leaves as also shown in table three which was realised as a result of seeds treated with hot water. The untreated seeds also gave an average height of 1.9 cm as shown in table one, and two leaves as in table two.

In another development, the seeds treated with 50% sulphuric acid were found to germinate better after 15 days of sowing. This is because the seed treated with hot water do better towards disrupting hard seeds than the control seeds which was not treated before

sowing. Based on the above observation, we can therefore easily agree with the fact that sulphuric acid treatment has significant effect on the emergence of Tamarind seeds. One can therefore sum up the experiment by saying that dormancy of Tamarindusindica could be associated with the seed coat. This because all the treatment carried out during this experiment was geared towards inducing hard seeds disturbance.

5. Conclusion

This research has discovered that treatment of Tamarindusindica with sulphuric acid as well as soaking it in hot water are among the factors which could best influence their germination. This could therefore serve as good methods to be adopted in order to save the specie from being extinct as it is ageing and fast disappearing, which could be as a result of those factors which could best break the dormancy of this seeds. Also the result obtained could best be used towards improving and replications of tamarind trees which could be used for:- food, wood, shed and for local medicine production. It will also be used towards improving the development of the arid zones as well as improve the environment.

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