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INFLUENCE OF DIFFERENT PRETREATMENTS ON SEED GERMINATION AND GROWTH RATE OF *Adansonia digitata* (Aaertn) SEEDLINGS

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ABSTRACT

Adansonia digitata is an important medicinal and economic species. However, the seed dormancy is a factor to its domestication and natural regeneration. The study was carried out to investigate the effects of pretreatment on the germination and growth response of Adansonia digitata. The study was carried out at Forestry Nursery, University of Agriculture Makurdi. The seeds were immersed in cold water at 25^{o}C for 6hrs, hot water or 100^{o}Cfor 10min. and 98% sulphuric acid at 1hr and sown without treatment(control) and replicated thrice. After the pretreatment, the seeds were sown in 15 x 13cm polypots filled with top soil. Completely Randomized Design was adopted for the experiment. The experiment lasted for 8 weeks. Data was collected on day of emergence, germination percentage, number of leaves, plant height and length on weekly basis. Analysis of Variance (ANOVA) was employed for the analysis. Duncan Multiple Range Test(DMRT) was used for mean separation. The results revealed that H_2SO_4 at 98% for 1hr emerged earlier on the 4th day after sowing. Also from the findings,H_2SO_4 was seen to enhance germination percentage(93.33%)and growth performance in terms of plant height (15cm), number of leaves(6) and leaf length(6cm) respectively The rest treatment did not show any significant difference on the seed germination and growth rate. Based on the findings, it is concluded that to raise a large scale of Adansonia digitata seedlings in the nursery for conservation purposes, pretreatment of seeds in 98% H_2SO_4 for 1hr should be adopted.

KEY WORDS: Pretreatment, germination, growth response, *Adansonia digitata*

INTRODUCTION

Seed germination is one of the most important stages in life cycle of plants and it is initiated when the apparent metabolic dormancy of desiccated seeds is disrupted by imbibitions(Agboola 2003, Ajiboye 2010). Seed is considered as the ripened ovule which comes out due to proper fertilization. A matured seed consists of seed coat and embryo which is the young plant enclosed within the seed coat. The major storage of food materials of seeds are carbohydrate, lipids, protein which provide energy and other nutritional requirements of the growing embryo(Satyanrayana *et al.*, 2011).Seeds require vital conditions for germination such as supply of oxygen, water and favourable temperature and light. Seed of many plant species cannot germinate despite favourable environmental conditions such as light, temperature, moisture and oxygen required for germination as a result of seed dormancy. Dormancy breaking is very important when rapid germination is required after sowing (Aref, 2000).

Adansonia digitata (Baobab) a multipurpose tree species is one of such species. It belongs to the Malvaceae family and occur throughout semi-arid and arid zones of Africa. It is a massive, deciduous tree up to 25m in height and may live for hundreds of years. Its survival is, however threatened by

bush fire, overexploitation grazing and lack of natural regeneration (Assogbadjo *et al.,* 2011). The tree sheds its leaves during the dry season which can last most of the year depending on the climate zone. African baobab is a long-lived tree with multipurpose uses (Sidibe and William, 2002).It tends to grow as solitary individuals and is sensitive to water logging and frost.

Adansonia digitata is a majestic tree revered in Africa for its medicinal and nutritive value. The plant parts are used to treat various ailments such as diarrhea, malaria and microbial infections. The seeds, leaves, roots, flowers, fruit pulp and bark are edible. Baobab leaves are used in the preparation of soup and the seeds are used for thickening agent. Several research findings show that a dried baobab leaves contains 13-15% protein, 60-70% carbohydrate, 4-10% fats, around 11% fibre and 16% ash. The energy value varies from 1180-1900kj/100g of which 80% are metabolisable energy (Gebauer*et al*.,2002). The leaves contain significant nutritional components that are good for human health and maintenance (Abiona *et al.,* 2015). The seeds are pressed for oil, but the by-product baobab oil seed meal is typically underutilized. Most of the previous studies on the baobab fruit have focused on the seed oil.

Natural regeneration and independent germination of *A.digiata* is poor (Basin *et al.,* (2000).The seeds are known to stay dormant in the soil for long time before germination. Cultivation of *A.digitata* necessitates that the seeds be pretreated to enhance the accessibility of water and oxygen before planting. The species is facing a high risk of extinction because of lack of its natural regeneration and hence practical ex situ conservation measures are urgently needed to preserve genetic diversity and maintain multiple specimens(Gebauer*et al.,* 2002).Thus, the need to investigate the effects of pretreatment techniques on breaking dormancy, germination response and growth rate of *Adansonia digitata.*

MATERIALS AND METHOD

Study sites

The experiment was conducted at the Forestry Nursery of the University of Agriculture, Makurdi. The Nursery is located within the Guinea Savannah zone between latitudes 8^{o}35E and 8^{o}41E and longitudes 7^{o}45N and 7^{o}52N. The mean annual rainfall is between 1000mm-15000m while the mean annual temperature is between 29^{o}C -50^{o}C and relative humidity is between 60%and 80% but decreases in the early months of dry season (Ikyaagba, 2008).

Seed Collection and Procedure

The pods were harvested from the mother tree at Aperrwagh (Gidan Kuka) in Agwatashi District in Obi Local Government Area of Nassarawa State. The pods were opened up and the seeds were removed while the dry powdery coating was washed away. The extracted seeds were kept under a normal room temperature for period of 9 days. Viability test was carried out through the floatation method. A total number of 120 seeds were used for the experiment. Thirty(30) seeds were soaked in 98% $H_2SO_4$for 1hr. After soaking, the seeds were removed, washed and rinsed in running tap water until the seeds were ready to handle, after which the seeds were sown in polypots of equal size of 15 x13cmfilled with top soil.

Thirty (30) seeds were also soaked in distilled water (cold water)for 6hrs after which the seeds were sown inpolypots of equal size of 15 x13cm filled with topsoil.

Water was allowed to boil for (100^{o}C). Thereafter, thirty (30) seeds were added to the boiled water and allowed to boil further for 10mins.These boiled seeds were sown in polypots. Thirty(30) seeds were equally sown in polypots filled with topsoil without treatment (control).

Experimental Design and Data collection

The experiment was carried out in Completely Randomised Design involving four treatments,

growth medium and at a particular interval(6hrs, 1hr and 10min. respectively). Data were taken on emergence and germination percentage (Germination was recorded daily for 8 weeks until the cease of emerging germinated seeds. The seeds were considered germinated by a visible protrusion of seed coat with the cotyledon, hypocotyl and epicotyls on the surface of the soil. Germination percentage was calculated as thus:- Percentage germination = total number of germinated seeds/ seeds sown x 100.Growth parameters that were measured are;-plant height and leaf length.

Data Analysis

Data collected were subjected to Analysis of Variance (ANOVA).Mean separation was with Duncan's Multiple Range Test (DMRT).

RESULTS

The findings revealed that pretreatment reduced the period of dormancy as seeds pretreatedwith H_2SO_4 emerged earlier than the rest treatment(Table1). H_2SO_4emerged on the 4th day after sowing while the rest did not show any sign of germination. Highest germination percentage was recorded in H_2SO_4 at 93.33% while the rest show no effect(Table 1).

The mean plant height of the *Adansonia digitata* was observed in H_2SO_4(15.24cm) while the rest treatment did not respond. The mean number of leaves(6) was recorded for H_2SO_4. While the mean leaf length(6.19cm)was also recorded for H_2SO_4(Table 2).

The highest plant height was recorded in week 8(6.51cm) followed week 7(5.99cm). The least was obtained in week 1(0.37cm). The highest number of leaves was also recorded in week 8(3)and the least was recorded in week 1(0.14).The highest leaf length was recorded in week 8(2,8cm) while the least was recorded in week 1(0.20cm)(table 3).

Table 1:Germination percentage of *Adansonia digitata* seeds from different treatments

Treatment	Days of emergence	Number of seeds germinated	Total number of seeds sown	Germination percentage
Control	0^a	0^a	0^a	0.00^a
Hot water	0^a	0^a	0^a	0.00^a
Cold water	0^a	0^a	0^a	0.00^a
H_2SO_4	4^a	28^b	30^b	93.33^b

Means along each column bearing the same superscript are not significantly different from each other. Significant level 0.05

Table 2. Plant height, number of leaves and leaf length of *A.digitata* as influenced by Pre treatment

Treatment	Plant height	Number of leaves	Leaf length
Control	0.00^a	0.00^a	0.00^a
Hot water	0.00^a	0.00^a	0.00^a
Cold water	0.00^a	0.00^a	0.00^a
H_2SO_4	15.24^b	6.45^b	6.19^b

Means along each column bearing the same superscript are not significantly different from each other.

Table 3.Variation in plant height, number of leaves and leaf length of *A. digitata* across the weeks under H_2SO_4

Number of weeks	Plant height	Number of leaves	Leaf length
1	0.37	0.14	0.20
2	1.05	0.46	0.50
3	2.43	1.05	1.13
4	3.67	1.38	1.32
5	5.12	1.93	1.86
6	5.35	2.18	2.14
7	5.99	2.64	2.43
8	6.51	3.11	2.80

DISCUSSION

Germination emergence and percentage of A.*digitata seeds*

Acid treatment (H_2SO_4) was found to be effective for *A.digitata* seeds. This result is supported by several studies which reported that acid treatment is an efficient method of increasing and accelerating seed germination of species with hard impermeable seed coat. The earlier emergence of seeds of *A.digitata*from the finding agrees with the work of Ibiang *et al.,* (2012) who reported scarification with H_2SO_4 of *T.Tetraptera* for six days after sowing. The result obtained also collaborate with the work of Abubakar and Zubairu (2015) who recorded 3days after sowing of *Tamarindus indica* in H_2SO_4. Also it confirms the work of Falemara *et al.,(*2014) who reported mean day emergence of *Adansonia digitata* at 8 days after sowing in sulphuric acid. This result agrees with the termination of dormancy in seeds of *T.indica, P.biglobosa, A.lebbeck* and *P.africana* using concentrated sulphuric acid as a presowing agent (Ajiboye and Agboola (2011)..The germination percentage in sulphuric acid agrees with the work of Fasidi *et al.,*(2000) who observed that treatment with concentrated H_2SO_4 significantly increased germination ($P<0.01$). Biswas *et al*.,(1975) also terminated dormancy in seeds of *Richardia scabra* using concentrated H_2SO_4.

The result supported the findings of Yildiztugay *et al*., (2008) who reported that chemical scarification with $H_2SO_4$was the fastest and most effective dormancy breaking methods for *Sphaerophysa ktschyana*. This also agrees with the recommendation of Falemara *et al*., (2014) that acid scarification with H_2SO_4 for 1hr gave the best result and should be used in breaking dormancy of *A.digitata* seeds. This also can be attributed to the findings of Amusa (2011) on *Afzelia africana* who asserted the fact that the highest percentage germination accorded to acid treatment is an indication that the more rapidly the seed coat ruptured, the fastest the rate of germination. The reason is that sulphuric acid is thought to disrupt the seed coat and exposes the lumens of the cells permitting imbibitions of water which triggers germination (Nikolaeva, 1977).

The result disagrees with the work of Aref (2000) who obtained good germination in *Acacia Senegal* after boiling the seeds in H_2O and allowing it to cool to room temperature. The report also is in contrast to the work of Botshelenge*t al*., (2014) who obtained maximum germination percentage

(100%) of *Afzelia quanzensis* and *Baikiaeaplurijuga* in hot water for 9min. The finding conform to the work of Anglaare (2005) who reported 0% of *T.tetraptera* in cold water for 24 hrs.This fact is supported by McDonald *et al.*, (2002) who observed that immersing *Tamarindus indica* and *Prosopis africana* seeds in sulphuric acid for more than an hour damage many seeds and significantly reduced germination. The implication of this is that exposure of seeds to a high concentration for a very long time will have adverse effect on germination as confirmed byRojas*et al.,* (2011).

Seedling performance

At the end of sixty (60) days H_2SO_4 gave the best plant height, number of leaves and leaf length. The result disagrees with the work Yisau *et al.,* (2015) who reported seedling height of *Albizia zygia* with hot water treatment at 20^oC for 5minutes.The finding corroborates with that of Agbogidi *et al.,*(2007) who reported a highly significant effect of improving seed viability and enhancing seedling emergence and seedling growth of *Dacryodes edulis* with sulphuric acid. The implication is that hot water treatment is not a suitable technique for seeds of *Adansonia digitata* (Falemara *et al.,* 2014) as well as *Afzelia africana* as stated by Amusa (2011). The result is contrary to the work of Saikou *et al* (2008)who reported that pretreatment of *Acacia Senegal* seeds in hot water for 10min increase its growth potentials.

The increase across the weeks in all the growth parameters show the effectiveness of the seedlings to acid treatment.Week8 being the highest in all the growth performance is an indication that the *Adansonia digitata*is afast growing species.

Conclusion

The result of this study revealed that at the end of eight weeks, H_2SO_4 at 98% for 1hr gave the best result in seed emergence, percentage germination, plant height, number of leaves and leaf length.Based on the findings, 98% H_2SO_4 at 1hr should be employed to encourage afforestation and also farmers in domestication and conservation of the species.

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