EFFECTS OF DIFFERENT PRE-SOWING TREATMENTS ON THE GERMINATION OF *FAIDHERBIA ALBIDA*

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ABSTRACT

The study investigated the effects of five pre-treatment techniques on the germination of Faldabia albida seeds. The study was carried out at the nursery site of the Federal college of Forestry Jos, Plateau State. The seeds of Faldabia albida were immersed in concentrated tetraoxosulphate (vi) acid, hot water, cold water, coconut water and control. The treated and the untreated seeds (control) were sown in a bowl previously filled with top soil and watered for germination to take place. Number of seeds germinated per day was monitored and recorded for each treatment till no further germination is observed. The result shows that seeds treated with concentration tetraoxosulphate vi acid for 3 minutes had the lowest mean germination time (MGT) of 9.0 day, while seed soaked in cold water had the highest MGT value (13.4 days). The result on first day of germination (FDG) shows that all the seeds treated germinated on the six days after sowing while the control treatment germinated on tent day. Thus, concentration acid soaked 3mins was recommended for pre-treatment of Faldabia albida seeds prior to planting to improve germination performance.

Keywords: Germination, sowing, faidherbia albida, treatment

INTRODUCTION

Throughout the humid tropics, there are numerous woody species that have provided the indigenous people with food, medicine, construction wood and various other services (Leakey, 2017). Currently the majority of these products particularly medicinal plant are exploited extensively from the wild. Despite their numerous roles (provision of employment, income, food and rural health) their natural population has been diminishing both in size and gravity due to natural and human induced factors (Awotoye, Adebola and Matthew, 2013). Nigeria forests suffer from human abuse, misuse and overuse of their resources in order to satisfy immediate needs. The accelerated rate of forest destruction in Nigeria was put at approximately 280-500 hectares annually, and was projected that by year 2010 55% of the nation forest would have been destroyed.

F. albida, originally known as Acacia albida , belongs to the family of Fabaceae. Under favourable conditions, F. albida can reach more than 30 m in height and 1.5 m in diameter at breast height. The crown is pyramidal when the tree is young and becomes hemispherical with age. The leaves are compound and bipinnate. F. albida is a widely distributed species in the arid and semiarid zones of Africa. Unlike most Sahelian woody species, F. albida is a reverse phenology species: it loses its leaves with the first rains of the season and regrows them during the dry season. On the basis of seed analysis, Ibrahim, Zhang, Nivitanga, Afzal and Xu (2020) highlighted three ecotypes of F. albida in Africa: the Sahelian ecotype, the South African ecotype, and the ecotype that overlaps between the two zones, particularly in Ethiopia. In the same ecological zone, F. albida has contrasting morphological and growth variability. The trees have long been used traditionally in the principal agricultural production system in West Africa, known as parkland agroforest. F. albida is an excellent agroforestry species for its impact on improving soil carbon and soil fertility, increasing the activity of symbiotic microorganisms, and improving the yields and nutritional values of crops. Due to its deep root system in dune soils, the competition for superficial water and nutrient resources between this species and surrounding crops is very limited (Ibrahim et al., 2020).

Faidherbia genus of leguminous plants containing one species, Faidherbia albida, which was formerly widely included in the genus Acacia as Acacia albida. The species is native to Africa and it's commonly called apple-ring acacia because their circular seed pods resemble apple rings (Ismail, Mohamed, Marghany, Abdel-Motaal and Ibrahim, 2016; Osman and Abdelmageed, 2019). For a long time, this species was formerly called *Acacia albida*. It is a thorny tree growing up 6 – 30m (20–98 ft) tall and 2m (6.6 ft) in trunk diameter. It's highly resistant to drought due to deep-penetrating tap root. The bark is grey and fissured when old. According to Armstrong (2015), *F. albida* is found along flood plains of some areas in South Africa. *F. albida* flowers provide bee forage at the close of the rainy season showing it's important for raising bees, the seed pods are used for feeding livestock in Nigeria, and eaten by stock and game in Southern Africa (Neelo, Teketay, Kashe and Masamba, 2015). The leaves are eaten by elephant, antelope, buffalo, baboons and various browsers and grazers, though strangely ignored by warthog and zebra. The wood is used for canoes, mortars and pestles, and the bark is pounded in Nigeria and used as a packing material. Ashes of the wood are used as tanning agent for hides and as a depilatory and used in making soap. The wood is used for carving, the thorny branches is useful for a natural barbed fence. Some 90 % of Senegalese farmers interviewed by collected stored and rationed *Acacia albida* pods to livestock. It is valued in agroforestry as it fixes nitrogen, and a high yield has been achieved in at least one test plot of maize crops grown amongst the trees at a density of 100 to 25 tree per hectare (Kassam, Friedrich and Derpsch, 2018). According to a 2018 article by the Guardian news paper, monocultures of this species are popular in parts of Niger, where it is known as "gao" in Hausa, to use for intercropping (MacLean, 2018). It is also used for erosion control. Its value as an agroforestry tree cannot be overlooked as this species drops leaves during raining season which helps to add nutrient to the soil which invariably improves the growth and productivity of crops (Burrow, Burrow, Lotter, Schmidt, 2018; Becking, 2020). Extract from the bark of F. albida is used in traditional medicine in Southern Africa, and Niger (MacLean, 2018).

Tree dieback can be defined as the expression of the immediate effects of acute stresses. The causes of this dieback remain unknown.

However, many studies have addressed the decline of trees in plantations, natural forests, and farms around the world. *e causes are still debatable. Very often the most indexed causes have been folivores, infections, and abiotic stresses which can be linked mainly to climate or soils. Rural tree dieback could be linked by factors such as global climate change, overuse of pesticides, heavy metals in soils, overuse of fertilizers, pathogens, and habitat fragmentation. These factors have direct effects on the survival of symbiotic microorganisms (mycorrhizae) which play an important role in the life of trees. Based on all of these causes, theories and models of tree dieback have been developed. The interaction between several factors including biotic, abiotic, and human makes the study of tree dieback very complex. In his spiral of tree dieback and mortality, modified by main groups of causes are presented as follows:

(I) predisposition factors, namely, the tree genetics, the soil nutrient deficit, climatic variability, chemical, physical, and biological degradation of soils, and chronic attacks from pathogens and insects;
(ii) incentive and contributing factors such as extreme climate, high soil toxicity, insect defoliation, and competition.

There is the need to intensify effort on the cultivation of this plant species. For plants to efficiently propagate, germination is a requirement. Effective and sustainable germination of seeds is usually affected by seed structures and environmental factors, a condition referred to as seed dormancy (Asaadi, 2017). Though seed dormancy is often considered an impending factor, and many plants use it as a survival mechanism which ensures that germination occurs only during favourable conditions. Many forms of seed dormancy have been identified with the degree of dormancy varying depending on the species, genome and type of dormancy (Acar, Yasar and Ercisli, 2017) these include: physical, chemical, physiological, photo- or thermo-dormancy (Zembele and Ngulube, 2022) Many scholars have proposed pre-sowing treatment methods targeted at breaking seed dormancy in seeds with physical dormancy such as scarification by nicking hot water, concentrated sulphuric acid stratification and many others. (Al-Zhoubi, 2020). *Faidherbia albida* is of economic importance to human, animal and environment. In spite of the economic importance *F. albida,* the tree is not purposely planted by the farmers. The lack of purposeful propagation of this species is attributed to low germination, percentage of the seeds arising from the hard seed coat that lead to delayed germination. The negative consequence of this reduction in the number of naturally germinated seeds is the shortage of pioneer seedling as planting stock and this trend is currently putting the species under treat of extinction. The study assessed the effect of different pre-sowing treatment on the germination of *Faidherbia albida*.

Faidherbia albida often occurs in a park-like vegetation named Faidherbia parks, especially in West Africa, where it is widely intercropped with annual crops. Studies on the microclimate under *Faidherbia albida* trees demonstrated the beneficial effects of this on cropping. In densities 20-30 trees/ha, the potential evapotranspiration decreases by 50% during the dry season and 10% during the rainy season compared to cropping without trees. The soil dries out more slowly.

Yields of millet are much higher under a *Faidherbia albida* canopy; increases of 50-150% has been recorded. Results for sorghum, cotton, groundnut and maize are variable and either positive or negative, depending on the study. The effect may depend on soil fertility;

when this is high, *Faidherbia albida* competes with other crops.

The main causes of mortality during the first year are mainly accidental cutting during weeding of associated crops, and the inability to control excessive browsing by ruminant animals after crop harvesting. In Niger and Burkina Faso, the nematodes *Meloidogyne javanica* and *Meloidogyne incognita* attacks young plants in the nursery; older plants are resistant. Cochineal insects may also cause damage in the nursery; treatment with parathion is effective. Defoliating caterpillars (notably *Crypsotidia conifer*) are the main pest of the adult trees, defoliating trees in Nigeria and Zimbabwe by upto 50%. Infestation of seeds is mainly due to larvae of Bruchid beetles. Parasitic plants such as *Agelanthus dodoneifolius* (DC) polhill and weins, and strangler figs, such as *Ficus thonnigii* Blume, may infect the trees, but cause little damage.

MATERIALS AND METHODS

Experimental site

The study was carried at Federal college of Forestry nursery greenhouse located at latitude 9.94N and longitude 8. 89E.Bauchi Road Jos, Nigeria of the mean annual rainfall of 155.51 millimeter and the mean annual temperature of 28.41 degree centigrade.

Seed materials

The seeds of *F. albida* was obtained from Savanna Forestry Research Station Samaru Zaria seed store.

Experimental design

The experiment was laid out in a completely randomized design (CRD) with 5 treatments and 5 replicates.

Seed viability test

The seeds were subjected to seed viability test through floatation method, the seeds that floated on water were considered not viable while the ones that sank were collected and regarded as viable and further used in the study.

Experimental set up

The experiment consists of five (5) treatments (Conc. tetraoxosulphate (vi) acid, hot water, cold water, coconut water and control). The treatments were replicated three (3) times and arranged in Completely Randomized Design

	R1	R2	R3	R4
T1	T1R1	T1R2	T1R3	T1R4
T2	T2R1	T2R2	T2R3	T2R4
T3	T3R3	T3R2	T3R3	T3R4
T0	T0R1	T0R2	T0R3	T0R4

3.6 Experimental procedure

3.6.1 Seed germination

Seeds of Faldherbia albida was subjected to five pre-treatments as follows:

i. **Hot water treatment**

A hundred (100) seeds were placed in a container containing hot water heated to approximately 100° C and then left for 5 minutes. The seeds were drained and washed in cold water, then sown immediately.The seeds were sown into a germination box containing top soil

ii. **Cold water treatment**

One hundred seeds were placed in a container containing cold water at room temperature. The seeds were soaked for 24 hours, after which the seeds were drained and planted immediately in germination box containing top soil.

iii. **Concentrated acid treatment**

Another one hundred (100) seeds were first placed in a suitable container. Concentrated tetraoxosulphate (vi) acid was poured on the seeds and allowed for 3mins, the seeds were then thoroughly rinsed under running water after which it was sown into a germination box containing top soil.

iv. **Soaking in coconut water**

A hundred seed were soak in coconut water for 24 hours**.** The seeds were drained and washed in cold water, then sown immediately. The seed were sown into a germination box containing top soil

v. Control

A total of a hundred (100) seeds were planted without any treatment into another germination box filled with top soil.

Number of seeds germinated per day was monitored and recorded for each treatment. till no further germination is observed. Once counted, the seedlings were tagged to avoid double counting.

Data Collection

Data collected on germination was done for 8weeks

Calculations

$$\text{Germination Percentage} = \frac{\textit{Number of seeds germinated}}{\textit{Total number of seeds planted}} : \text{x } 100$$

$$\text{Mean germination time (MGT)} = \frac{\textit{Number of seeds germinated per day X Day after planting}}{\textit{Total number of seedlings germinated}}$$

First day of germination

Last day of germination

Time spread of germination = last day of germination – first day of germination

Data collected was computed using analysis of variance and subjected to mean value separation

RESULTS AND DISCUSSION

The effect of different pre-treatment on germination of *Faldherbia albida*seed.

Result in table 1 shows that seeds treated with concentration tetraoxosulphate iv acid for 3 minutes had the lowest mean germination time (MGT) of 9.0, this was followed by seeds treated with hot water for 10minutes (12.0 day). The seeds soaked in coconut water had 12.4 days while seed soaked in cold water had the highest MGT value (13.4 days). The result on first day of germination (FDG) shows that all the seeds treated germinated on the six days after sowing while the control treatment germinated on tent day.

The result shows that seeds soaked in conc acid had the fastest germination completion day at the thirty-four days (34day) after sowing, followed by seeds treated with hot water on forty days (40day). Seeds soaked in cold water had the lowest last day germination (LDG} at the thirty first (31day) day. Time spread of germination (TSG) shows that seeds soaked in hot water has the shortest germination circle of 26 days, while seeds soaking in cold water had the longest germination circle of 40 days.

The findings of this study revealed that the germination was not uniform for all the pre-treatment methods. This was in contrast with the report of Iroko, Sowumi, Ajekiigbe, Rufai, and Wahab (2021) that reported uniform and 100% germination rate across all the pretreatment process adopted in their study. However, the report was similar with the finding of Chuyong and Acidri (2015) who reported less than 100%

germination in all the pre-sowing treatments applied on *F. albida*. The best germination percentage was observed with the application of con. H_2SO_4. This was similar to the report of Iroko *et al*. (2021) who noted in their study that the seeds soaked in Conc. H_2SO_4 for 15 minutes gave the best in terms of germination value. Iroko *et al*. (2021) reiterated that the fast wearing off of the seed coat that allowed quick penetration of water into the seeds could be the reason.

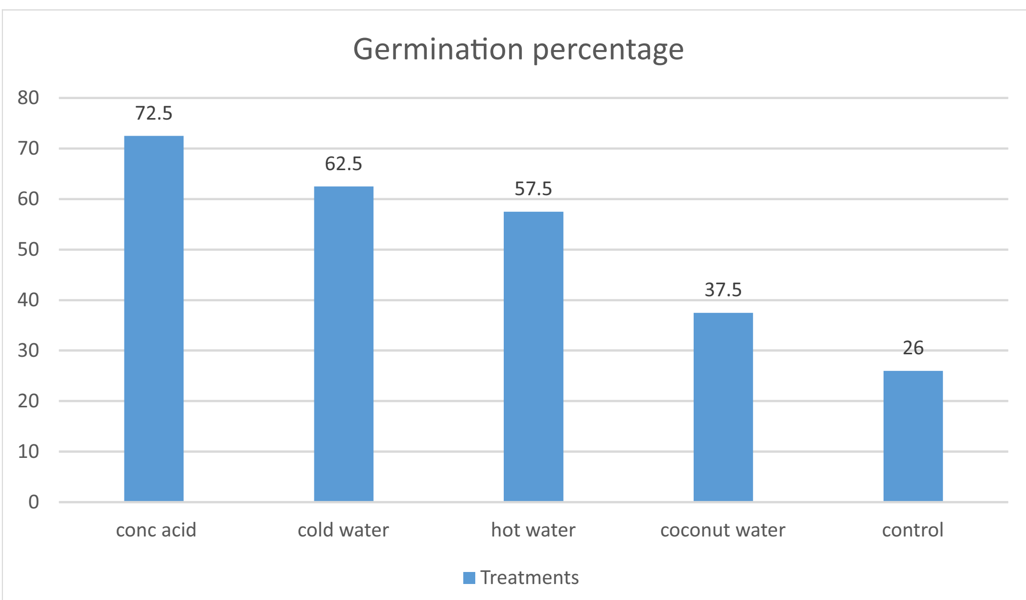
Table 1: Effect of different pre -treatment on germination of *Faldherbia albidal* seed.

Germination parameters	Hot water	Cold water	Concentrated H2SO4	Coco nut water	control
Mean germination time	12.0	13.4	9.0	12.4	13.0
Germination percentage	57.5	62.5	72.5	37.5	26
First day of germination	6	6	6	6	10
Last day of germination	44	40	35	44	30
Time spread of germination	26	34	29	38	40

Effect of different pre-treatment on germination percentage of *Faidherbia albida*seed

Result in figure 1 shows that seeds treated with concentratedH2SO4 for 3minutes had the highest germination percentage (GP) of 72.5 %, this was followed by seeds soaked in cold water (62.5 %) and 57.5 % hot water, (37.5%) coconut water, while the lowest GP was recorded for untreated seeds (26.0 %).

Figure 1 Percentage seed germination of *Faldherbia albida* seed



CONCLUSION AND RECOMMENDATIONS

The result of this study shows that pre-germination treatment such as soaking in concentrated acid, cold water, hot water and coconut water has greatly influence germination ability of *Faldebia albida*. Also the study has clearly established that different soil sources greatly influence the growth of *Dalderbia albida* seedlings. Therefore, as observed in the study that soaking concentration acid gave the highest percentage germination and the soil sourced from cultivated soil gave a better growth in relation to all the growth parameters examined. It is therefore recommended that for plantation establishment of *Falderba albida*, the seed should be soak in concentration H2SO4 for 3 minutes to break the seed dormancy and the seedling should be propagated in soil sourced from cultivated soil that has been left followed for some period of years.

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