Journal of Research in Forestry, Wildlife & Environment Vol. 9(1) March, 2017
http://www.ajol.info/index.php/jrfwe

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E-mail:jfewr@yahoo.com
ISBN: 2141 – 1778
Uleh and Fagbemi 2017

PROGENY TRIAL OF *Prosopis africana* IN BENUE STATE, NIGERIA.

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ABSTRACT

Progeny trial of Prosopis africana in Benue State, Nigeria was carried out in a pot culture experiment over a period of three months. The State was stratified into three zones and one Local Government Area was randomly selected from each zone for seed collection. The seeds were assessed for germination in the laboratory, and seedling emergence, bi-monthly height and numbers of leaves were taken on the field for three months. At the end of 90 days after sowing, seedling total dry matter weight was taken. Tetraoxosulphate (VI) acid (H_2SO_4) seed scarification gave the best germination (100%), followed by hot water (20%), while ordinary water led to no seed germination (0%). Seeds collected from zone A (derived savannah) showed the best performance in seedling height, leaf number and total biomass. Whereas, seeds from Zone B (Southern Guinea Savannah) gave the least. Based on the studies, Katsina-Ala (zone A) can be regarded as the best place for collection of seeds of Prosopis africana for plantation establishment.

Keywords: *Prosopis africana, progeny, seed germination, seedling emergence, seeds.*

INTRODUCTION

Prosopis africana (Guill, &Perr.) Taub is member of the family Fabaceae and subfamily Mimosoideae (Bradbeer, 1988; Dau and Chenge 2016). It is one of the most popular known leguminous trees in the savanna region and the only *Prosopis* native to inter-tropical Africa.

In Nigeria, the tree is found in Nupe, Zamfara, Kaduna, Katagum, Yola and Enugu areas (Hutchison and Dalziel, 1958; Ajiboye Ajiboye *et al.*, 2014). Other states include Taraba, Nasarawa, Kogi and Benue. *Prosopis africana* is used in many areas of human set up. Its uses have gained national acceptance and vary from one locality to another. The wood can be used in making high quality household items such as mortars, axe handles and knife handles. Also farm handles, walking sticks and props, tobacco pipes, fire wood, charcoal, mallet and single membrane drums are made from it. In more advanced environment, the wood is recommended for cabinet work and wheelwright work, bed, chairs, boat building, especially for the ribs of the board and for turnery. It is also used as railway sleepers (Ajiboye *et al.*, 2014; Dau and Chenge 2016).

Prosopis africana tree has a very dark and scaly bark, slash orange to red brown with white streaks. It is noted that the tree is thornless with alternate bipinnate leaflets (Keay, 1989; Onochie and Stanfield, 1964). Mature tree crowns are oblong, lanceolate 12-30mm, the radius 10-15cm long. Leaves are deciduous. The tree flowers between December and May shortly before the onset of rain and produces auxiliary spikes with hairy calyx, a villous ovary, glabrous petals and standing stamens. The anthers possess a small gland (Keay, 1989).

Successful production of healthy seedlings in the nursery can be ensured through progeny trial using viable seeds. It should be noted that in Nigeria, most important tree species are fast depleting due to annual bush burning and over-exploitation of the existing natural forests (Ajiboye *et al.*, 2014). This challenged can be reduced by plantation establishment of indigenous species through artificial regeneration.

Progeny trial of *Prosopis africana* as this work entails is finding out the best source of seeds using Benue State as a case study. In consideration of the invaluable importance of *Prosopis africana* to man, a reliable source of seed collection is necessary for any successful plantation establishment.

MATERIALS AND METHODS

Study Area

The project was conducted in the laboratory and Forest Nursery located at the University of Agriculture experimental farm. The University of Agriculture Makurdi lies between Longitude 8^o 35'E and 8^o 49'E and Latitude 7^o 45'N and 7^o 50'N. It is located within the southern guinea savanna zone. The mean annual temperature is 31.5^oC with relative humidity of between 65% - 90%. The area has 7 months of rainy season with a total annual rainfall of from 700mm – 950mm (Ogunjimi, 2004).

Seed collection

To ensure that the experimental seeds were indigenous to the location, Benue State was stratified into three zones based on observed variation of the forest cover of the state and land use. From each of the zones, a Local Government Area was selected using random sampling method. Katsina-Ala for zone A, Makurdi for zone B and Okpokwu for zone C. In all the three zones, *Prosopis africana* was observed to be readily available. The seeds of *Prosopis africana* were obtained by cracking the pods with a stone of moderate size.

METHODOLOGY

In the laboratory, nine Petri-dishes were used with three per zone as replicates. In each zone the treatments used are; hot water, control (ordinary water) and sulphuric acid.

Treatment of seeds

i. Ordinary water: Ten (10) seeds of *Prosopis africana* were placed in 9 cm diameter Petri dishes on tissue papers moistened with water for 14 days to observe radical emergence.

ii. Hot water: For the hot water, 10 seeds of *Prosopis africana* were poured in boiled water (100^oC) in 1:10 seed to hot water ratio by volume and left over-night.

iii. Acid treatment : This involved using sulphuric acid in 1:10 acid to seed ratio by volume for 30 minutes. The treated seeds were then washed thoroughly with water and transferred to the Petri dishes containing moistened tissue paper for germination assessment.

All the Petri-dishes were then laid out in a Completely Randomized Design and watered daily.

Experimental design

Topsoil used in the experiment was obtained from Forest Nursery at the South Core axis of the University of Agriculture Makurdi. The soil collected was thoroughly mixed. Nine (9) pots (0.04 m^2 surface area) previously perforated for drainage were divided into three, one group per zone. Equal quantity of soil was fed into pots, and watered properly to field capacity. Seeds of *Prosopis africana* were first tested for viability through the floatation method. After the viability test, the weight of 100 seeds per zone was determined in grammes using electrical weighing balance. The seeds found viable and weight already determined were given pre-sowing treatment by subjecting them to concentrated sulphuric acid scarification in seed to acid ratio of 10:1 for 30 minutes. There were three treatments replicated three times namely zones A, B and C. At an interval of two weeks (bi-monthly) the height and numbers of compound leaves were counted and recorded. Biomass assessment involving the dry matter of root, stem and leaves were also determined at the end of 90 days after sowing.

Data collection

Radical emergence of the seeds was observed on a daily basis for 14 days and recorded. Two weeks after sowing, measurement of chosen parameters commenced. Data were collected on the following parameters, namely: tree seedling height, leaf number and dry matter and at the end of the experiment. Data collected were analyzed with descriptive statistics.

RESULTS AND DISCUSSION

Germination

As shown in figure 1, radical emergence commenced in acid (sulphuric) treated seeds on the fifth day after in Petri-dish in Zone B. For the two weeks duration of the investigation no germination was observed in the control (ordinary water) treated in all the seeds from the three zones. Within the range of 5 – 14 days the mean percentage germination was 80%, 100% and 100% with acid scarification for zones A, B and C respectively. Only 20% germination was recorded in hot water treatment and it was only in zone C. Unlike acid treatment, radicle emergence did not start until 8 days after in hot water treatment. However, the percentage emergence did not vary very much among the zones with acid treatment ranging from 80% for zone A, 100% for zone B and 100% for zone C. This would indicate that sulphuric acid performed above average in all the zones considered.

This result is in accord with that of Fagbemi and Isaac (2001) with regards to the need for acid scarification to enhance early germination of seeds of *Prosopis africana*. However, due to the cost and danger associated with the use of sulphuric acid at the rural level the use of hot water to aid germination of seeds by this tree species has been indicated. The discussed results are on figure 1.

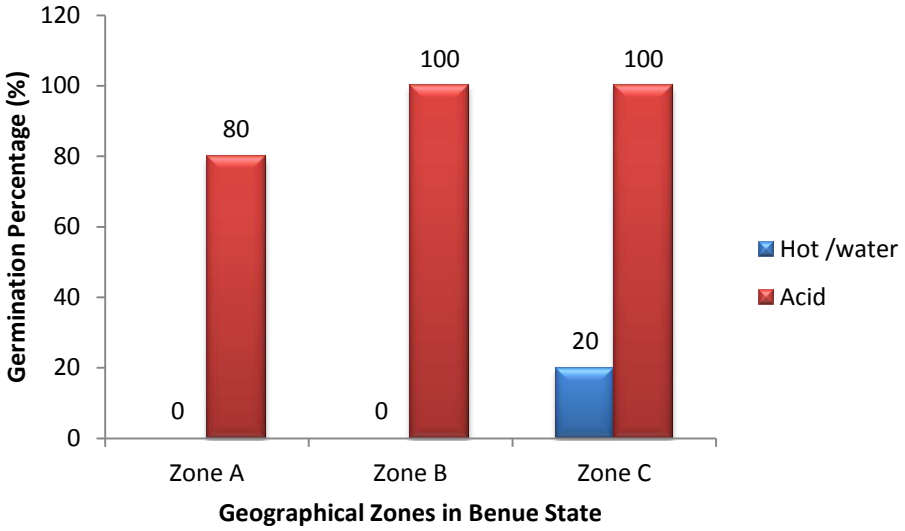

Figure 1: Percentage of radical emergence of *Prosopis africana* from different treatments observed between 5 – 14 days in petri-dishes

Height

At the end of 90 days of observation, the best height of *Prosopis africana* was recorded in zone A (40 cm) and zone C (34 cm) as shown in figure 2. The least height, which though does not differ significantly from zones A and C, is zone B (24 cm). The variation in height among the three zones that is insignificant shows that *Prosopis africana* does well in all zones considered as seed source. This height result with no significant difference is in line with the findings of (Diagne, 1994). This author has reported no variation in height of *Prosopis* collected from seven provenances in Ecuador and one provenance in Senegal. *Prosopis africana* seeds collected from any of the three zones considered as seed source will do above average in height based on the outcome of this study.

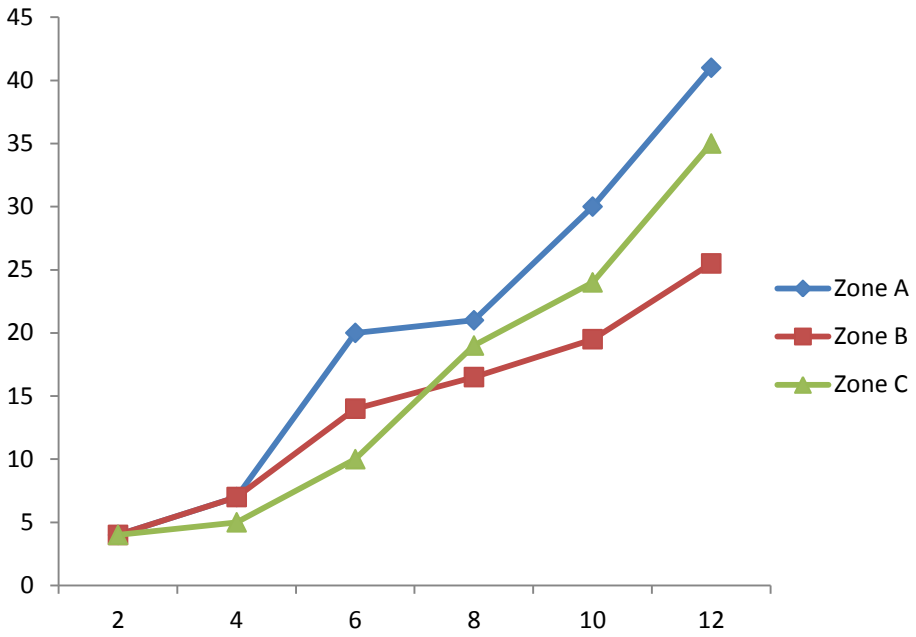

Figure 2: Height of *Prosopis africana* from three zones in Benue State within 90 days

Biomass Assessment

As shown in figure 3, the highest total mean dry weights (roots stems and leaves) of (0.98g) were obtained from zone A at the end of the three months of growth. However, the lowest (0.98g) was produced by zone B. This value was lesser when compared to the total dry matter weight obtained from zones A and C. The partitioned biomass in percentage has the highest leaf contribution in zone A (56.8g) and the least in zone B (54.75g). For the stem, the highest percentage was however in zone C (23.2g) and the least in zone B (21.6g). The difference in stem contribution in terms of dry weight is small when comparing zones A and B as shown in figure 4. However, for the roots the least contribution was recorded in zone C (21.2g) and the highest in zone B (23.65g).

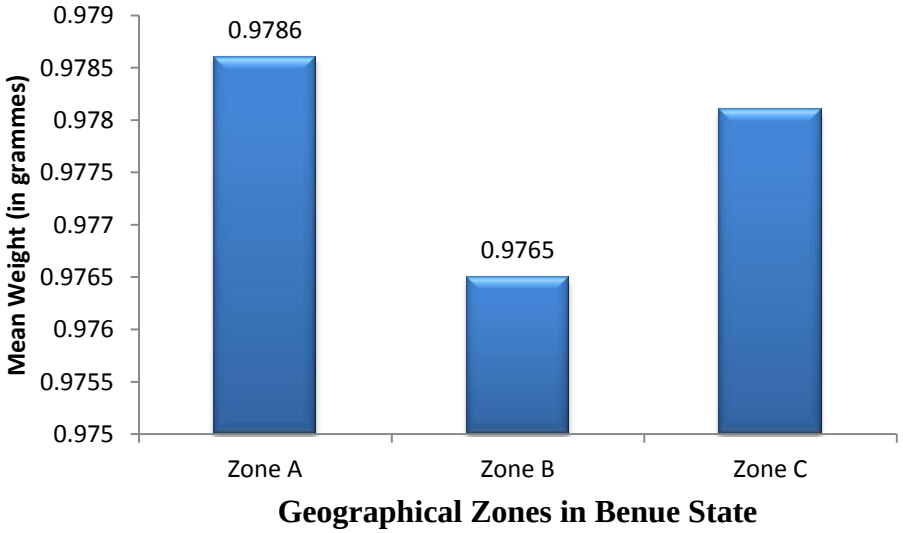

Figure 3: Total Biomass (root, stem and leaf) of *Prosopis africana* for different zones three months after sowing

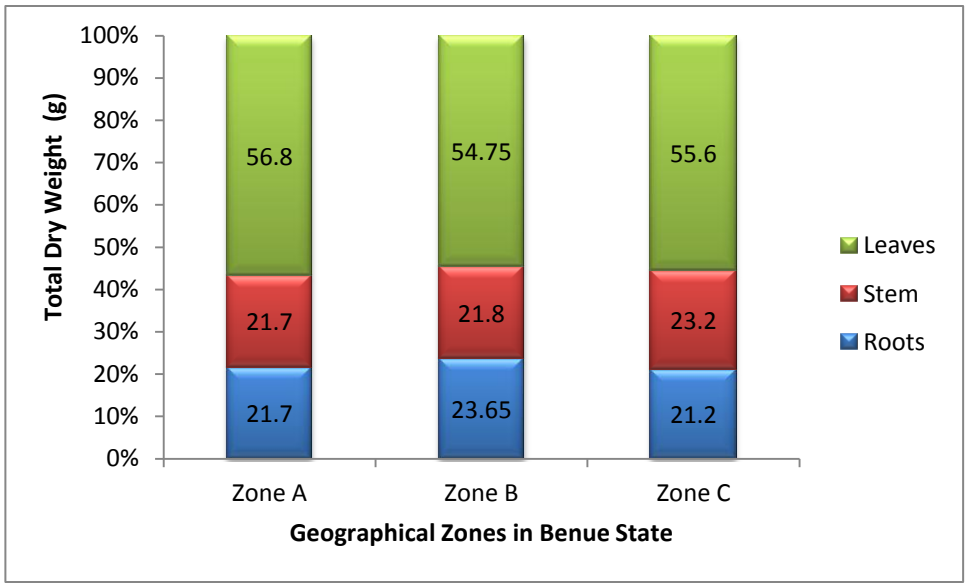

Figure 4: Weight of Biomass

Number of leaves

On the field, the highest number of compound leaves was observed in zone A (29) when compared to other treatments. While the least number of compound leaves was recorded in zone B (26). No significant difference was observed in the number of compound leaves produced by *Prosopis africana* in the treatments investigated. From table 1 the means of number of compound leaves showed that zone A treatment was better than other treatments throughout the experimental period.

Table 1: Number of compound leaves per seedling of *Prosopis africana* at different locations

Treatments	2WAP	4WAP	6WAP	8WAP	10WAP	12WAP
ZONE A	2.67	5.33	9.00	17.67	22.67	28.67
ZONE B	2.33	4.67	8.67	17.00	21.33	26.33
ZONE C	2.33	5.00	9.33	17.33	22.00	27.33
LSD	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

NS – Not significantly different at 5% level of probability
LSD – Least Significant Difference
WAP – Week After Planting
Zone A – Katsina – Ala
Zone B – Makurdi
Zone C – Okpokwu

CONCLUSION

Prosopis africana seeds collected from zone A demonstrated a better growth potential on the average than seeds collected from zone B and C. However, based on the results obtained from these findings *Prosopis africana* may thrive well if the seeds are collected from the zones considered for the study. Further still, the experiment has also helped to confirm the superiority of acid to other treatments like hot water and ordinary water in breaking dormancy in seeds of *Prosopis africana*. Testa rupture is faster with acid than with any of

the other treatments used for the study. The study also shows that *Prosopis africana* does not take very long time to grow, hence plantation establishment of the species would be profitable especially in rural setup due to its numerous uses by peasants.

REFERENCES

Ajiboye A.A., Fawibe O.O., Atayese M.O. and Agboola D.A. 2014: Some aspects of the Seed Germination and Seedling Growth of two Savanna tree Species: *Prosopis africana* and *Dialium guineense*. Journal of Advanced Laboratory Research in Biology 5(4): 188 – 193.

Bradbeer, J.W. (1988): *Seed Dormancy and Germination.* Chapman and Hall, USA.

Dau, J. C. and Chenge, B. I. (2016): Growth Space Requirement Model for *Prosopis africana* (Guill. & Perr.) Taub Tree Species In Makurdi, Nigeria. *European Journal of Biological Research*. **6**(3): 209 – 217.

Diagne, O. (1994): Recent Development in Biological Nitrogen Fixation Research in Africa. Proceedings of the fifth conference of African Association for Biological Nitrogen Fixation (AABNF) Held at the Hassan II Institute of Agronomy and Veterinary Medicine (IAV), Rabat, Morocco, 14 – 19 September 1992. Edited by M. Sadiki and A. Hilali pp 253 – 262.

Fagbemi, T. and Isaac, A.O. (2001): Effects of Soil $_p$Hon Seedling Emergence, Growth and Nodulation of *Prosopis africana* and *Leucaena leucocephala*. *Journal of Agric. Sci and Technology*. 9 – 10: 76 – 81.

Hutchison, T. and Dalziel, E.K. (1958): Plant Propagation Principles and Practices 2nd Edition. USA.

Keay, R .J .W. (1989): Trees of Nigeria. Oxford University Press, New York (USA).

Ogunjimi, O. (2004): The effects of Plantation Media on Growth and Development of *Gmelina arborea* Seedlings.

Onochie, C. F. and Stanfield, D. P. (1964): Nigerian Trees. Nigerian National Press Lagos.