
**GERMINATION CAPACITY STIMULATION OF THE “ALBIZZIA LEBBECK”
SEEDS UNDER BOMA CONDITIONS IN THE DEMOCRATIC REPUBLIC OF
CONGO**

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ABSTRACT

The beginning of the reforestation being assisted germination, it seems essential to know if the seeds of different tree species germinate without problems or if they have some problems, for in finding appropriate methods of germination. This study aims to stimulate the seeds germination of « Albizzia lebeck » in the experimental plantation of University President Joseph Kasavubu at Km 8 Boma site, according they are soaked in hot water at 90 ° C or in water at ambient temperature (25 ° C). Thirty seeds were planted in each of three blocks (floors) chosen, and three samples were taken at 20 days interval. Data on the seeds number taken from each treatment and each block were statistically analyzed in using the software R. The results show that hot water at 90 ° C over stimulated seeds germination (germination rate of 80%), followed by water at 25 ° C (germination rate of 70%) and the control (untreated seeds, 50%). The properties of water at 90 ° C exceeds that of water at 25 ° C to stimulate germination, better, to break dormancy. It is therefore possible to subject the seeds of « Albizzia lebeck » to different treatments and get good results.

Keywords: Power germinal seeds, Albizzia lebeck

Introduction

The forest resources of the Democratic Republic of Congo are subject to numerous interventions for their conservation as well as for their artisanal and commercial exploitation [1]-[6]-[7]. The most recent estimates suggest a further increase in deforestation, with nearly 2 million hectares lost between 2005 and 2010 [18]. These forests are subject to skimming, which involves harvesting only the trees of a few species whose commercial value justifies their research and is not accompanied by any measure in favour of the renewal of the exploited population [15]-[16]. Faced with this danger that threatens the environment as well as humanity as a whole, questions have been asked and continue to be asked: Should we continue to exploit the forest by benefiting

from its rich services and by jeopardizing the future of the planet ? Should we preserve the forest and no longer benefit from its riches and give hope to our generation and future generations? Many possible solutions have been proposed, including sustainable forest exploitation and replanting and replenishment work [10]-[17]. As the beginning of the reforestation is assisted germination [2], it is essential to know if the seeds of different forest species germinate smoothly or have some whims, for finding appropriate methods to facilitate their germination. Hence the importance of testing the germinative power of tree species. It is in this perspective that the choice of this theme is made. The "*Albizia lebeck*" species is chosen in this study because it is a legume that can fertilize the soil, hence its use in agroforestry [2] - [4]. This species is used for many purposes: timber, construction poles, crafts, fodder, etc [8]-[11]. The seeds germination of « *Albizia lebeck* » can be improved with a soak in hot water for some time [2] - [5].

In this study, the hypothesis is that the use of dormancy lifting methods by soaking the « *Albizia lebeck* » seeds in hot water at 90 ° C and lukewarm water at 25 ° C would stimulate in the same way the germinative power of seeds presenting germinating whims.

The general objective of this work is to achieve the rapid germination of « *Albizia lebeck* ». Its specific objectives are to stimulate the germinative power of the seeds of « *Albizia lebeck* » in the experimental plantation of University President Joseph Kasa-Vubu located at Km 8 in Boma, according to their soaking in hot water at 90 ° C or in warm water at 25 ° C.

2. MATERIALS AND METHODS

2.1. Study area

This study was carried out in the University President Kasa-Vubu experimental plantation located at Km 8 in the Boma city, in the "Kongo Central" Province in DRC. The site is at an altitude of 500 m, at latitude 13 ° 21 'South, and at a longitude 5 ° 52' 32 " East. It is characterized by a tropical climate with an alternation of 2 seasons; the rainy season that begins theoretically from October 15th to May, while the dry season begins May 15th to October 15th [9]. The site is dominated by a grassy shrub formation enriched with "*Acacia spp*" and a somme "*Albizia lebeck*" species due to the sandy-clay soil [2]-[5]. The sandy-clay soil of Boma is characterized by fertility due to the presence of the Mbangu, Kalamu, Kabondo and Sindi rivers.

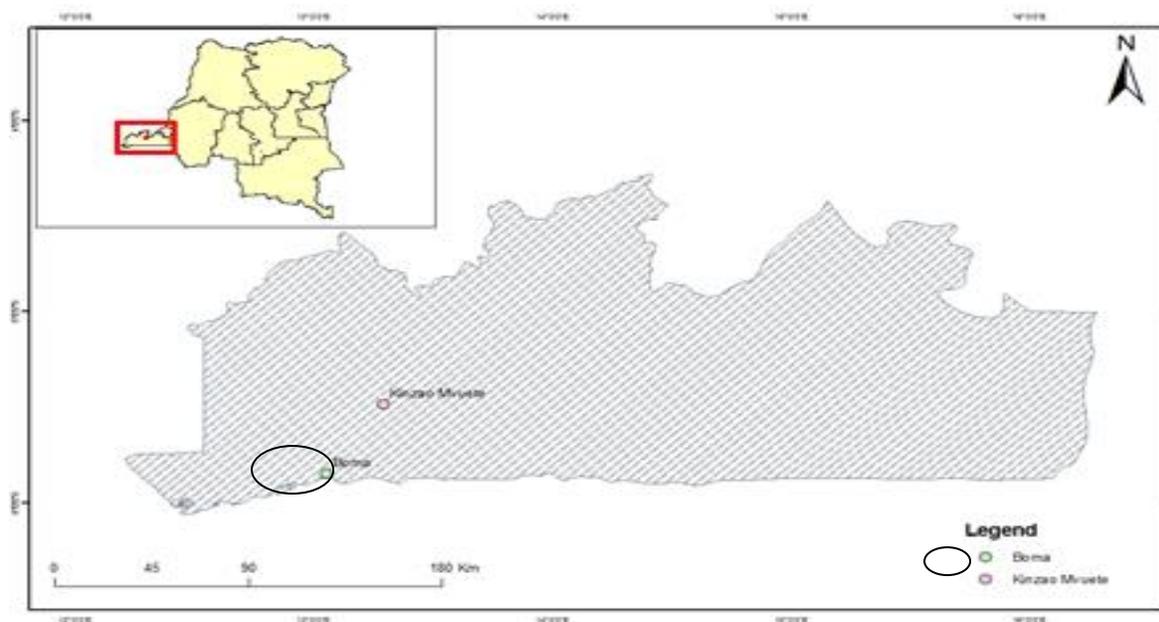


Figure 1. Location of study area

2.2. Experimentation

The biological material of this study consists of the « *Albizia lebeck* » seeds. These seeds were randomly collected at the experimental site of Km 8 in Boma. Pending the preparation of the land for 2 days (clearing, cutting, etc.) with a machete and plowing the soil with a hoe, the « *Albizia lebeck* » seeds picked up during the dry season have been stored in sachets. The experiment idea was to test the germinative power of the « *Albizia lebeck* » seeds, according to their soaking in hot water at 100 ° C or in lukewarm water at 25 ° C [2]. The first treatment concerned the « *Albizia lebeck* » seeds soaked in a basin of lukewarm water at 25 ° C for 24 hours (A₁), and the second treatment concerned the Albizzia seeds soaked in a basin of hot water at 90 ° C for 24 hours (A₂). Seeds without treatment have served as control or reference (A₁₀). Ninety seeds were subsequently sown, due to 30 seeds per block at a depth of 5 cm and a distance of 20 cm. In each block, there were 10 seeds of « *Albizia lebeck* » soaked in water at 25 ° C, 10 seeds of Albizzia soaked in hot water at 90 ° C, and 10 control seeds. Treatments and blocks were indicated using labels. The first sampling of the « *Albizia lebeck* » seeds seeded per treatment and per block occurred 20 days after sowing, the second sampling occurred 40 days after sowing and the third sampling 60 days after sowing [2].

2.3. Statistical processing of data

The numerical values of the « *Albizia lebbek* » seeds taken by treatment were recorded on the software R for their comparison. The analysis of the variance was applied at a threshold of 5% probability.

3. RESULTS

3.1. ANALYSIS OF THE VARIANCE

Table 1. Analysis of the variance about the effect of treatments applied to seeds

Source of variation	Statistical parameters					
	Df	SS	AS	F value	P	Decision
Block	2	2.6667	1.3333	0.4615	0.651	NS
Residuals/Block	6	17.3333	2.8889	-	-	-
Treatment	2	14	7	7	0.027	*
Residuals/ Treatment	6	6	1	-	-	-

NS - not significant; S (*) – significant at the 5 % probability threshold; Df–degree of freedom ; SS– squares sum ; AS– Average square

The results in Table 1 show that the difference between the number of seeds germinated in each block (soil) is not statistically significant. The selected bocs did not affect the germination of the « *Albizia lebbek* » seeds. However, the significant difference between treatments could be demonstrated at the 5% probability threshold.

3.2 GERMINATION OF SEEDS

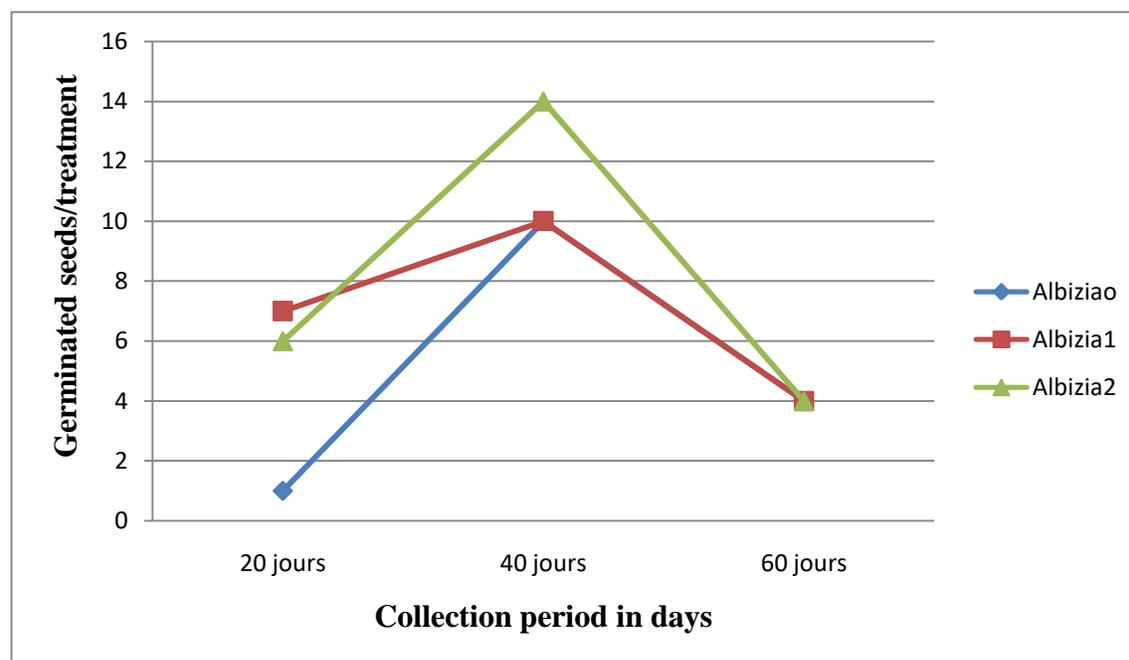
Table 2. Germination capacity of Albizia seeds after seeding

Treatment	Number of germinated seeds / treatment					
	20 jours	40 jours	60 jours	TGS	TSS	Pr (%)
Albizia ₀	1	10	4	15	30	50
Albizia ₁	7	10	4	21	30	70
Albizia ₂	6	14	4	24	30	80
TGS	14	34	12	60	90	66,66

*TGS : Total germinated seeds - * TSS : Total sown seeds- * Pr : proportion

Table 2 shows the number of seeds removed per treatment for the three samples taken during the experiment. This table shows that at 60 days after seeding (experimental period) for a total of 30 seeds sown per treatment, 15 seeds have been lifted for the control Albizia (ie 50%), 21 seeds for the Albizia soaked in water at 25 ° C (70%), and 24 seeds for Albizia soaked in hot water at 90 ° C (80%).

Figure 2 shows the evolution of the number of seeds lifted per treatment during the sampling periods. It should be noted that during the first harvest at 20 days, the seeds soaked in water at 25 ° C had germinated very much compared to other treatments. At 40 days, the peak was at the curve of seeds soaked in water at 90 ° C. At 60 days, the three curves had the tendency to decrease from such a sign that the three treatments had given the same number of germinated seeds.



* Albiziao: Albizia seeds not having undergone any treatment - * Albizia1: Albizia seeds soaked in water at 25 ° C - * Albizia2: Albizia seeds soaked in hot water at 90 ° C.

Figure 2. Evolution of seeds lifted by treatment during the sowing period

4. DISCUSSION

The well-known importance of the species "*Albizia lebeck*" in reforestation is no longer to be demonstrated. According to [2] and [8], the species is highly valued in Africa where it is exploited for its wood, its ability to improve soil by nitrogen fixation, and for its leaves used as fodder. That why, in this study, we tried to stimulate the germinative power of this species seeds by using the different treatments as recommended [5]. The different treatments applied were effective in influencing the germination capacity of "*Albizia lebeck*", but hot water at 90 ° C stimulated the seed emergence, followed by lukewarm water at 25 ° C.

We can therefore confirm the hypothesis of [2] - [5] that hot water is effective in stimulating the « *Albizia lebeck* » seeds germination. These authors think that seed germination is improved by soaking in hot water for a few minutes and in cooling water. [12] also think that germination times are longer under natural conditions (ie when seeds are not treated). The germination rate is approximately 30%.

These results also agree with those of [3] who had revealed in a similar study that "*Pycnanthus angolensis*" seeds soaked in hot water at 90 ° C had higher leveled seeds than seeds soaked in water at 25 ° C and untreated seeds.

By evaluating the performance of seed production in three varieties of "*Stylosanthes guianensis*" (Aublet) Swartz, under the conditions of the Batéké Plateau in the Democratic Republic of Congo, [4] found similar results to those of [2] - [3] - [5] - [12] by stimulating seed germination with the warm water.

However, these results contradicted those obtained by [14] who had demonstrated that untreated, « *Terminalia mentaly* » seeds had more yield than seeds soaked in hot water at 90° C. This is due to the fact that the hot water at 90 ° C interferes with the germination conditions of the « *Terminalia mentaly* » seeds and this may be an exceptional case for the aforementioned species.

The similar Results to those of [14] were also found by [13] in observing good germination efficiency of untreated controls over other treated seeds. This would be explained by the fact that, under certain conditions, the untreated seeds can germinate easily. [2] also think that untreated fresh seeds cause young shoots to emerge at about 5 days of sowing with a 65% success rate.

According to the figure 2 about the evolution of lifted seeds per treatment during the sowing period, the tendency of the curves shows that it was the 40-day sampling that caused many seeds to germinate. This would be due to the fact that the 40-day period could be the optimum period for germinating the seeds of Albizia.

5. CONCLUSION

This study focused on the germination stimulation of the « *Albizzia lebbeck* » seeds at the Boma Km 8 site.

The methodology of the study consisted in collecting at random 90 seeds of *Albizzia lebbeck* so that their germinative power could be tested. It also consisted of selecting two factors, the treatment and the block. In each block, 30 seeds were sown, respecting the proportion of 1/3 per treatment. Three samples were taken at an interval of 20 days. The variance analysis test was applied for different treatments for drawing statistical conclusions.

The results obtained revealed that the difference between the germinated seeds number in each block is not statistically significant. The selected bocs did not influence the *Albizzia* seeds germination. However, a significant difference between treatments could be demonstrated at the

5% probability threshold. The different treatments applied have been effective in influencing the germplasm of Albizia. Hot water at 90 ° C stimulated seed germination more than warm water. It should be clear that the properties of hot water exceed those of warm water for stimulating germinative power, better, to lift the dormancy. This experiment allowed to know that it is possible to subject the seeds of Albizia lebeck to different treatments and to obtain good results. Hot water at 90 ° C gives better results than warm water at 25 ° C, and both treatments give better results than those obtained with untreated Albizia seeds. The 40-day period could be the optimum period for germinating the seeds of Albizia.

With regard to all the above, we suggest to the Boma population to use the Albizzia lebeck for reforestation, given its characteristics; and soak the seeds of Albizzia lebeck in the hot water to stimulate their germinative power.

6. References

- [1] Benneker, C., Assumani, D.M., Maindo, A., Bola, F., Kimbuani, G., Lescuyer, G., Esuka, J.C., Kasongo, E. et Begaa, S. 2012. Le bois à l'ordre du jour. Exploitation artisanale de bois d'œuvre en RD Congo : Secteur porteur d'espoir pour le développement de petites et moyennes entreprises. Tropenbos International RDC Congo, Wageningen, Pays-Bas, 278 p.
- [2] Blaser, J., Rajoelison, G., Tsiza, G., Rajemison, M., Rabevohitra, R., Randrianjafy, H., Razafindrianilana, N., Rakotovao, G., Comtet, S. 1993. Choix des essences pour la sylviculture à Madagascar. Akon'ny Ala , 12-13.
- [3] Bodi, M. et Dintoka, K. 2014. Expérimentation de la germination assistée de *Pycnanthus angolensis* par différentes méthodes de levée de dormance. Travail de recherche de statistique, biométrie et expérimentation. Faculté des Sciences Agronomiques, Université de Kasa-Vubu, Boma.
- [4] Bulakali, B.P., Aloni, J., Palata, JC et Mergeai, G. 2013. Evaluation des performances de la production de graines par tamisage manuel du sol chez trois variétés de *Stylosanthes guianensis* (Aublet) Swartz , dans les conditions du Plateau des Batéké (RDC). *Tropicultura*, 31, 4, 253-259.
- [5] Cooke, B., Burren, C. et Rakotoniaina, M. 1993. Promotion des plantations des arbres à Madagascar. Fiches techniques, Maquette : Stève Ramiaramanantsoa, Madagascar.
- [6] Desclée, B., Mayaux, P., Hansen, M., Lola, P.A, Sannier, C., Mertens, B., Hausler, T., Ngamabou, S.R, Poilve, H., Gond, V., Rahm, M., Haarpainter, J., Kibambe, J.P, 2014. Évolution du couvert forestier du niveau national au régional et moteurs de changement In : Les forêts du

bassin du Congo-État des forêts 2013, de Wasseige, C., Hynn, J., Louppe, D., Hiol Hiol, F., Mayaux, P. (Eds) 2014, Weyrich, Belgique, pp 21-46

[7] Devers, D. 2007. Quel avenir pour les forêts de la République démocratique du Congo? Rapport sur l'état des forêts du Bassin du Congo 2006 : Processus et perspectives, Bruxelles.

[8] Gnahoua, G.M., Nguessan, K., Balle P. 2014. Les jachères de légumineuses arborescentes : Sources potentielles de bois énergie et de service en Côte d'Ivoire. Journal of Applied. Biosciences. 81:7290 – 7297.

[9] Institut géographique de Boma, 2015. Mairie de Boma et Service de l'Environnement, Boma.

[10] Khasa P.D., 1995. Développement d'un programme intégré d'amélioration génétique du *Racosperma* spp. Pour le reboisement des terres marginales zaïroise. In secheresse n°3, Sept. 1995, vol 6 : 281-8.

[11] Krisnawati, H., Kallio, M. and Kanninen, M. 2011. *Acacia mangium* Willd.: ecology, silviculture and productivity. CIFOR, Bogor, Indonesia. www.cifor.cgiar.org

[12] Latham P. et Konde K., 2006. Quelques plantes utiles de la province du Bas- Congo, République Démocratique du Congo, 2ème édition, p 330.

[13] Moupela, C., Doucet, J.L., Kasso, D., Quentin, M. et Vermeulen, C. Essais de propagation par semis et marcottage aérien de *Coula edulis* Baill. Et perspectives pour sa domestication. Bois et forêts des tropiques, n° 3 1 8 (4) :3-13.

[14] Niati, N., Sevolo, M. et Makoso, P. 2014. Expérimentation de la germination assistée de *Terminalia* par différentes méthodes de levée de dormance. Travail de recherche de statistique, biométrie et expérimentation. Faculté des Sciences Agronomiques, Université de Kasa-Vubu, Boma.

[15] Onotamba, P. 2011. Activité cambiale et croissance de *Pericopsis elata* (Harms) Van Meeuwen: inventaire forestier et analyse diachronique d'échantillons de la zone cambiale dans les Réserves de Yoko et de Yangambi (Province Orientale/RDC). Mémoire de Diplôme d'Etude Supérieure en Aménagement durable des forêts. Option Eaux et Forêts, Faculté des Sciences Agronomiques, Université de Kisangani, République Démocratique du Congo.

[16] Toirambe, B., Kapa, S., et Malele, S. 2006. Gestion des concessions forestières en République Démocratique du Congo. Pp. 217-238 In R. Matale (éd.). Exploitation et gestion durable des forêts en Afrique centrale. Direction de la gestion forestière (DGF), Kinshasa.

[17] Vermeulen, C., Dubiez, E., Proce, P., Mukumary, S.D., Yamba-Yamba, T., Mutambwe, S., Peltier, R., Marien, J.N., et Doucet, J.L. 2011. Enjeux fonciers, exploitation des ressources naturelles et forêts des communautés locales en périphérie de Kinshasa, RDC. *Biotechnol. Agron. Soc. Environ.* 2011 15(4), 535-544.

[18] Vermeulen, C., Karsenty, A., Gillet. 2015. Les concessions forestières des communautés locales : une avancée potentielle pour la foresterie sociale? Communication présentée à la Maison des Parlementaires à l'occasion du séminaire "Conjonctures congolaises 2014 : Politiques, territoires et ressources naturelles : changements et continuités". Gembloux Agro-Biotech, Université de Liège, Belgique.

6. ACKNOWLEDGMENTS

Our thanks go to the Faculties of Agronomic Sciences from Universities of Kinshasa, Kikwit and Lubumbashi for their proven contributions to this research.