



Evaluation Of The Effect Of Pre-Treatment Of Moringa Oleifera Lamarck (Moringaceae) Seeds At The Early Stage Of Germination For Massive Production In South Benin

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Abstract

Moringa Oleifera Lam., a tropical tree with multiple uses, used as a vegetable, is part of the eating habits of rural and urban communities. This study, which took place in the city of Cotonou, aims to contribute to a massive production of Moringa plants with a view to its promotion. In this line, an experimental protocol has been set down. Thus, four types of seed pretreatments were tested on a nursery whose plants are randomly arranged in four blocks of 30 plants with four repetitions. The treatments consisted of a

control (seeds not pretreated) of seeds pre-heated to 50°C, seeds soaked for 48 hours in water and scarified seeds. The variables measured are the speed of germination, the height of the plants, the length of the stems and the number of leaves.. The results obtained show that the germination time is significantly better already from the 5th day after sowing for the heated seeds with a germination rate of 74.16%. As for scarified and soaked seeds, the germination rate is low 42.5%. However, at the development stage, the scarified seeds have a better stem height from the 50th day after sowing, a significant difference is observed between the controls (44,52); scarified (48.66) and seeds heated to 45 ° C (41.38) and a similar difference between controls (44.52) and soaked 48h (43.28). the same result is obtained for the length of the leaves from the 20th day after sowing or there is a significant difference ($P = 0.0228$) between the plants of the batches of scarified seeds and the seeds soaked for 48 hours and a similar difference between the soaked for 48 hours and the seedlings heated (6,17). On the other hand, the number of sheets parameter does not vary considerably depending on the pre-treatments. At the start of the experiment, a significant difference ($P = 0.0011$) was observed between the plants whose seeds were heated (3.43) and the soaked 48h (3.00) and the controls (2.57) and scarified (2.97). Decision makers must take steps to make *Moringa Oleifera* accessible to all populations through the creation of plantations for exploitation.

Keywords: *Moringa Oleifera*, Nursery, Seed Treatment, Mass Production, Cotonou

Introduction

Moringa Oléifera is a plant species native to northern India and is now acclimatized in almost all tropical regions. It is a shrub up to 10 meters tall and belongs to the Moringaceae family (Makker *et al.*; 1997 et Arbonnier, 2000). *Moringa Oléifera* is described as a "tree of life", a "miracle tree" or a "divine plant" because of its many nutritional, medicinal and industrial potentials (Fulgie, 2001 et Olson, 2001).

Moringa Oléifera can be found in very arid areas like the Sahara, but it prefers humid semi-tropical climates (FAO, 2008 et Broin, 2010) and can adapt to any type of soil but adapts better to the hills and the borders of rivers (Palou *et al.*; 2011). It reproduces easily by seeds and by cuttings. It can be cultivated intensively irrigated for optimal production of leaves in order to harvest them every six weeks (Palada *et al.*; 2009). It can also be grown in house culture or in an intercropping system (Palou *et al.*; 2011)

However, the interest given to this tree by many researchers in tropical countries where malnutrition is legion is due to these many qualities and virtues. Indeed, it has been proved by [9] that practically all the parts of

Moringa Oléifera are used according to their contents in oil, in polypeptides and in growth factors.

Studies have shown that fresh leaf juice can increase yields by 25-30% for many crops (Foidl, 2001; fuglie 2001; Basra *et al.*; 2009, Makker *et al.*; 2010).

In Benin, the popularization of Moringa Oléifera started faintly since 1997. It was from 2002; that the 'Peace Corps Benin' 'supported with (Ogoudadja *et al.*; 2006) the NGO Garpe gave a boost to the marketing of Moringa Oléifera plants. The fact is that the production of fruit vegetables in southwest Benin does not seem sufficient to meet the demand of the population. This is due to a small amount produced by market gardeners. However, Moringa Oléifera appears to be a solution to alleviate the huge evils from which the Beninese population suffers (Adjatin, 2006; Hedji *et al.*; 2014). They must crash into this plant to better use it. The access to this plant and its leaves remain respectively more and more difficult and rare on our markets despite the efforts of research structures, non-governmental, national and international organizations for the popularization of this plant in Benin. As the multiplication of a plant depends on its germination capacity, the study of the effect of a few pretreatments germination in the southwest of Benin, an area where the climate is different from that of the North is very importante. The ultimate goal will be to facilitate its popularization in the area for its multiple virtues.

Materials and methods

Presentation of the study area

The study area covers the southwest part of Cotonou in the Littoral department. The climate is subequatorial with an alternation of two rainy seasons (from April to July and September to November) and two dry seasons (from December to March and August). The pluviometry varies between 900 and 1200 mm, while the average temperature is around 27°C with a maritime influence (Boko *et Adam*, 1994). The soil is sandy and poor in organic matter with a low exchange capacity and a low water retention capacity. The vegetation is sparse and scattered, consisting mainly of halophytes (Boko *et Adam*, 1994). Agricultural activities are reduced to market gardening (Figure 1).



Figure 1. Situation map of the study area

Plant material

The plant material consists of *Moringa Oléifera* plants obtained in the nursery. *Moringa Oléifera* seeds obtained from the NGO "wake up" were subjected to three different types of pretreatment. The first was heating the seeds to 50°C, then comes the scarification and the third soaking in cold water for 48 hours. A fourth group of seeds did not undergo any pretreatment and was considered as a control (Photo 1).



Photo 1. *Moringa Oléifera* plants

Experimental protocol

A nursery measuring 5m out of five has been set up to shelter plots of 20 pots repeated four times for each treatment according to the experimental plan. The sieved potting soil was brought to the site few days before sowing; then the bag of potting soil was made in the shade of a tree during the day. A straw shade house has been built on the site. One seed from each group of pretreated seeds was sown on each plot (consisting of 30 sachets) separately. *Moringa Oléifera* seeds were put in the nursery after scarification, heating to 50°C and soaking for 48 hours; some of the seeds were also put in the nursery without pretreatment and considered as a control. The first two treatments were carried out during the day, however the soaked seeds remained in the shade for 48 hours. Every morning the beds were abundantly watered to capacity in the field. A total of 480 seeds of *M. Oléifera* were used for the experiment. Every morning, the boards were abundantly watered to capacity in the field. Data on seed germination was collected every ten days. They relate to the time of trick (date of the seed trick after sowing), the number of seeds lifted per treatment, the average height of the plants, the length of the leaves, and the number of leaves. The data were collected over 2 months using a measuring tape and a graduated measuring ruler (Photo 2).



Photo 2. Experimental device

Data processing and analysis

Data collection took place on the germination of *Moringa Oleifera* seeds in the nursery under the effect of some treatments. The variables are: the height of the stems; the number of sheets; the length of the leaves and the speed of germination. Here, the Excel spreadsheet was used for entering and recording the collected data. This spreadsheet made it possible to transform the data in a histogram form or in tabular matter. The data relating to the average height of the plants, the length of the leaves, the number of leaves and the speed of germination as a function of time were subject of the analysis of a variance (ANOVA) with the STATITIX 8 software. The test LDS made it possible to compare the average and structure them into different classes. The results of the analysis were presented in tabular matter.

Results

Average seed germination rate

The experiment results reveal a very high germination rate in seeds heated to 50°C (74.16%) followed by controls (51.66%). As for the scarified and soaked seeds, the germination rate is low with (42.5%). The germination time is 3 days for pre-treated seeds and 4 days for controls. It can therefore be said that the pretreatment of the seeds has a positive effect on the percentage of germinated heating seeds in particular, and also on the germination time (Table 1).

Table 1. Average germination rate per treatment

Treatment	Average germination rate
witness	51,66 %
scarified	42,5 %
soaked 48h	42,5 %
heated	74,16 %

Source: Experimental results, 2019

Evaluation of the growth parameters of *Moringa Oléifera* plants

The results of the analysis of variance (ANOVA) for the stem height parameters, leaf length and number of leaves are summarized in tables 2, 3 and 4. It appears from table 2 that there is a significant difference from the 10th day after sowing between the soaked 48 hours (8.74) controls (11.59) and scarified seeds (9.98). There are no significant differences between scarified (9,98) and seeds heated to 50°C (10,25). There is no significant difference from the 20th JAS to the 40th JAS. On the other hand, a significant difference is observed between the controls (44.52), the scarified ones (48.66) and the seeds heated to 45 ° C (41.38) from the 50th JAS. A similar difference is observed between the controls (44.52) and the 48-hour soaks (43.28). This means that from the pretreatment effect of the seeds, the scarification is favorable to the stems parameter from the 50th JAS. Table 3 shows that for the leaf length parameter, a significant difference ($P = 0.0021$) at the 10th JAS between the 48h soaking and the controls; no significant difference between the scarified (4.05), and the heated seeds (4.22) and the controls (4.34). On the other hand, there is a significant difference ($P = 0.0228$) between the plants of the batches of scarified seeds and the seeds soaked for 48 hours from the 20th JAS. However, a similar difference is observed between 48h soaking and heated seedlings (6,17). At the 30th JAS, there is a similar difference between the 48-hour soaking and the controls and a significant difference between the seedlings of the scarified seeds and the controls. At the 40th JAS, a significant difference is observed between the seedlings of the scarified seeds (7.56) and those soaked for 48 hours (7.00) and the seedlings of the heated seeds (6.79) and the controls (7.33). We observe in the 50th JAS the same trends observed in the 30th JAS. It therefore follows that the pretreatment of the seeds, in particular scarification has a positive effect on the parameter length of the leaves during our experiment compared to the batches of controls. Table 8 presents the results of the variation in the number of leaves per plant. A significant difference is observed at the beginning of the experiment ($P = 0.0011$) between the plants whose seeds have been heated (3.43), the soaked for 48 hours (3.00), the controls (2.57), the scarified ones (2,97). However, no significant difference was observed in the rest of the experiment. We therefore conclude that the seed pretreatment effect has no significant impact on the number of leaves parameter.

Table 2. The results analysis of the height (cm) parameter of the *Moringa Oleifera* stems depending on the treatments

JAS	TREATMENTS				P
	Witness	Scarified	Soaked 48h	Heated 45°C	
10	11,59A	9,98AB	8,74B	10,25AB	0,1131
20	20,36A	19,65A	18,99A	17,04A	0,5492
30	26,61A	26,65A	26,56A	26,06A	0,9899

40	35,54A	47,41A	35,33A	33,16A	0,2553
50	44,52AB	48,66A	43,28AB	41,38B	0,1303

Source: Experimental results, 2019

JAS = number of days after sowing, the averages in the rows bearing the same letters are not significantly different at the 5% threshold

Table 3. The results analysis of the length (cm) parameter of the Moringa Oleifera leaves according to the treatments

JAS	TRAITEMENTS				LSD	p
	Witness	Scarified	Soaked 48h	Heated 45°C		
10	4,34A	4,05A	2,96B	4,22A	0,2982	0,0021
20	6,58AB	6,86A	6,32B	6,17B	0,1986	0,0228
30	6,98AB	7,27A	6,84AB	6,55B	0,243	0,0739
40	7,33AB	7,56A	7,00BC	6,79C	0,1967	0,0093
50	7,58AB	7,78A	7,65AB	7,24B	0,1925	0,0827

Source: Experimental results, 2019

JAS = number of days after sowing, the averages in the rows bearing the same letters are not significantly different at the 5% threshold

Table 4. The results analysis for the number of leaves parameter of Moringa Oleifera according to the treatments

JAS	TREATMENTS				P
	Witness	Scarified	Soaked 48h	Heated 45°C	
10	2,97B	2,97B	3,00A	3,43A	0,0011
20	6,04A	6,04A	6,00B	6,00B	0,1678
30	7,26B	7,62A	7,58B	7,64A	0,1814
40	9,28A	9,41A	9,37A	9,37A	0,9549
50	11,31A	11,37A	11,28A	11,08A	0,7464

Source: Experimental results, 2019

JAS = number of days after sowing, the averages in the rows bearing the same letters are not significantly different at the 5% threshold

Discussion

The current study has shown that the germination rate is quite high for Moringa Oleifera seeds preheated to 45°C (74.16%.) according to (Pamo, *et al.*; 2004). Heating the seeds significantly accelerates the speed of germination. It is also an effective way to soften the seed coat and therefore reduce its impermeability to water. In addition, according to (Robertson *et al.*; 1997, Moussa *et al.*; 1998), the heating of seeds allows the revival of the metabolic activity of the seed and therefore the development of the embryo. On the other hand, the low percentage of germination observed in pre-soaked and scarified seeds would be due to the exposure of the embryos to rots and to attacks by parasites. Indeed after soaking the seeds for 48 hours, the solution containing the seeds is very heavy and thick. This phenomenon can be explained by a probable diffusion of the sugars and proteins contained in the

seed in the water. The results on the germination rates are different from those obtained by the work of (Njehoya *et al.*; 2014) in the Sudano-Guinean zone of Cameroon. Indeed, the latter obtain a rate of 96% for scarified seeds. This variation in rates could be related to the differences observed between the origins of the seeds. These authors in their works have proven a correlation between the origin of the seeds and their germination rates. As part of our experiment, the pre-treated seeds germinated faster than the control seeds (1 day less than the controls). This result is therefore supported by the assertion of Sohdi and Harris cited by (Bourou, 2004) in Senegal on two local varieties of cowpea (*Vigna unguiculata*). According to these authors, the difference in germination time of the pre-soaked seeds and the control seeds is 1 to 3 days. The germination time of *Moringa Oléifera* seeds is 12 days (Gamate, 2006). But during our experimentation, the germination time was 4 days for untreated seeds. The time for germination of *Moringa Oléifera* seeds is therefore between 3-12 days. However, the trend changes during the plant development phase so that the growth of plants from heated seeds slows down compared to control batches. This trend can be explained by the fact that the heating of the seeds does not allow the growth hormone to quickly activate. On the other hand, the scarification allows better development of stems and leaves (Fakeye, 2008). The development of seedlings from scarified seeds could be due to the rapid use of seed reserves and which favored growth. These results are consistent with those obtained by (Abdellaoui, 2014) who showed that scarification has activated the development and growth of young seedlings for two species of *Hédysarum*. The latter claims that scarification did not harm the development of seedlings. For rapid germination, pre-treatment of seeds is therefore essential. We obtained plants of 70 cm height in 50 days. thanks to the pre-treatment.

Conclusion and suggestions

It results from this study that the scarified seeds have a low germination rate (42.5%) but develop faster. Seeds heated to 45°C have a high germination rate (74.16%) and slow growth. Witnesses behave better than seeds soaked for 48 hours. On the one hand, these results will allow nurserymen to reduce the duration of germination and at the same time obtain very high germination rates and therefore a significant biomass.

Thus, the following suggestions have been made in order to have a deeper and broader knowledge of the potential of *Moringa Oléifera*:

- Consider studies to better understand the impact of seed storage conditions on the germination of *Moringa Oléifera*;
- Develop efficient intensive and semi-intensive cultivation systems and cultural practices that respect the environment in Benin;
- Repeat the same tests in the agro-ecological conditions of North Benin;

- Repeat the tests and this with other pre-treatment methods.

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