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Original article

Promising Use of Alpha-Spin[r] Nano Particles Bombardment for Selection of Useful Variations in *Moringa Oleifera* Seedlings in Nigeria

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Abstract

The germination and some morphological development parameters such as number of branches, plant height, number of leaves, stem girth and number of leaflets was observed for *Moringa oleifera* treated with alpha spin nanoparticles in Lafia, Nigeria. The treated seeds were laid out in a randomized complete block design (RCBD) after four levels of treatments at 10minutes, 20minutes, 30minutes, 40minutes and 60 minutes. These along with control treatments were replicated three times in the field and allowed to undergo normal cultural practices as at when due. Data was collected for germination, plant height, number of branches, total number of leaves, stem girth and number of leaflets. The data was analyzed statistically using GENSTAT statistical software and treatment means were separated by the least significant differences (LSD) at 5% probability from the analysis of variance (ANOVA). The effect of the treatments on germination at the level of 10 minutes and 15 minutes exposure was not significantly different from the control but there was observed difference when the exposure increased to 30 minutes and 1 hour. Similarly the other growth parameters responded to the treatments by showing a significant difference in the treatments at 30 minutes and 1 hour exposure to the treatments. These results are discussed with a view to obtaining genetically diverse and useful variants.

Keywords: Alpha Spin, Nano Particles, *Moringa oleifera*, Selection, Nigeria.

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INTRODUCTION

Moringa of *Moringaceae* family has 13 species (namely, *M. arborea,* indigenous to Kenya; *M. rivae* indigenous to Kenya and Ethiopia; *M. borziana,* indigenous to Somalia and Kenya; *M. pygmaea* indigenous to Somalia; *M. longituba* indigenous to Kenya, Ethiopia and Somalia; *M. stenopetala* indigenous to Kenya and Ethiopia; *M ruspoliana* indigenous to Ethiopia; *M. ovalifolia* indigenous to Namibia and Angola; *M. drouhardii, M. hildebrandi* indigenous to Madagascar; *M. peregrine* indigenous to Red sea and Horn of Africa, *M. concanensis*, *Moringa oleifera* indigenous to sub-Himalayan tracts of Northern India (Popoola and Obembe, 2013).

Moringa oleifera has so far become the most used and studied mainly because it is a fast growing soft wood tree that can reach 12m height (Sharma *et al.*,2011; Roloff *et al*., 2009). Its multiple uses and potential attracted the attention of farmers and researchers in past historical eras. Ayurvedic traditional medicine says that *Moringa oleifera* can prevent 300 diseases and its leaves have been exploited both for preventive and curative purposes (Anwar et al., 2007; Ganguly, 2013).

The species has been dubbed “miracle tree”, or “natural gift”, or “mother’s best friend” and it grows in any tropical and subtropical country with peculiar environmental features, namely, dry to moist tropical or subtropical climate, with annual precipitation of 760 to 2500 mm (it requires less than 800 mm irrigation) and temperature between 18 and 28°C (Nouman et al., 2014).

Moringa oleifera has found wide acceptance among various ethnic groups in Nigeria, who exploit it for different uses that cut across food and medicine (Abe and Ohtani, 2013; Yabesh et al., 2014; Kasolo et al., 2010). The production is achieved in two main ways i.e by seed sowing and by cuttings. Sowing requires selection of the seeds, when they are easily available and human labor is limited, while the possibility to transplant seedlings allows flexibility in field planting even if it requires extra labor and costs. Seeds germinate within two weeks, at a maximum 2cm depth. When sowing is planned in nursery, the seedlings can be transplanted when they reach about 30cm (3–6 weeks after germination) (Ojiako et al., 2011). The number of seeds per kilogram ranges from 3000 to 9000, depending on the variety, with a germination rate of 80%–90% for ideal storage conditions (3°C, 5%–8% moisture). However, the viability decreases if seeds remain at ambient temperature and high relative humidity, their germination rate dropping to 7.5% after three months (Morton, 1991; Roloff et al., 2009). Cutting is preferred when seeds availability is scarce and/or when labor is not a limiting factor. (Ramachandran et al.,1980) reports that plants raised from seeds produce fruits of poorer quality, while Animashaun, et al. (2013), suggests that trees grown from seeds develop longer roots (an advantage for stabilization and access to water) compared to that grown from cuttings that have much shorter roots.

Nanoparticles are atomic or molecular aggregates with at least one dimension between 1 and 100nm (Ball, 2002; Roco, 2003), that can drastically modify their physio-chemical properties compared to the bulk material (Nel et al., 2006). The majority of the reported studies point to positive impacts of nanoparticles on plant growth with a few isolated studies pertaining to negative effect. In order to understand the possible benefits of applying nanotechnology to agriculture, the first step should be to analyze penetration and transport of nanoparticles in plants. The recent advances in nanotechnology and its use in the field of agriculture are increasing; and this led to this study which was carried out to investigate the effect of different treatments of alpha nanoparticles on the germination and growth of *Moringa* seeds. The specific objectives were to evaluate the role of nanoparticles on the seed germination of *Moringa* seed, evaluate the treatments on the growth and development of the plant and to compare treated and non-treated plants.

Materials and Methods

The research was carried out at the Research and Experimental field of the Botanical Garden of the Federal University Lafia, Nasarawa State, Nigeria between June and September 2017. The study area falls within the guinea savannah zone of north of Central Nigeria and is located between latitude 08.33N and longitude 08.32E. The *Moringa oleifera* seeds were treated using an Alpha Spin device for 10, 15, 20, 30 and 60 minutes and treatments along with the control were planted in a randomized complete block design (RCBD) with three replications. Cultural practices like clearing, harrowing, landscaping and weeding was performed according to the recommended practices for *Moringa* cultivation.

Data was collected for germination at 14 and 21 days after planting and for plant height, number of leaves, number of branches, stem girth and numbers of leaflets on the plant at 42 DAP, 60 DAP and at 90 DAP. All data collected was subjected to statistical analysis using GENSTAT Software Significantly different means were separated using the least significant difference (LSD) at 5% of probability.

Figure 1. Alpha spin disc

Results and Discussion

Seed germination provides a suitable foundation for plant growth, development and yield. In the present study, the results showed that there was no significant difference between the treatments for seed germination for the control and the timing of the exposure. All treatments as compared to the control meanwhile seed germination and growth results indicate that growing *Moringa* at the normal conditions required for propagation of *Moringa*, maximum exposure of 1hr(T4) and minimum exposure of 5 mins(T1) enhanced growth of the six different characters studied. It is probably that nanoparticles penetrate the seed coat and exerts beneficial effects on the process of seed germination. Based on the studies of nanoparticles' effects on seed germination mechanisms, it is possible that nanoparticles increase water absorption by seeds (Zheng et al., 2005), increase the abilities to absorb nutrients and utilize water. These changes improve seed germination in some plant species.

Table 1 below shows that there is no significant difference between the treatments as compared to control. The germination ranged from 4.166 to 4.496 with control treatment having the highest mean values. However, significant difference was observed for the growth characters such as number of leaves, number of branches, plant height and the number of leaflets.

Table 1. Effect of Treatments on Germination of *Moringa* at 21DAP and other Growth Parameters at 60 DAP

Treatment Time (Minutes)	Number of germinated seeds(21 DAP)	Number of leaves (60DAP)	Number of branches (60DAP)	Plant height (60DAP)	Stem girth (60DAP)	Numer of leaflets (60DAP)
0	3.906	64.7667	13.0333	51.6000	4.0212	1420.8667
10	4.400	68.6667	13.8333	53.7000	4.2000	1930.6000
20	4.166	69.4332	13.8667	54.6667	4.0667	1920.7667
30	4.533	70.8467	14.2667	61.5333	4.1000	1973.3779
60	4.966	71.0333	14.4333	65.3000	4.4333	1786.1333
$LSD_{0.05}$	1.059	5.667	1.127	13.144	0.557	264.664

Table 2. Growth and Related Traits as influenced by time for *Moringa* at 90 DAP

Treatment Time (Minutes)	Number of leaves (90DAP)	Number of branches (90DAP)	Plant height (90DAP)	Stem girth (90DAP)	Number of leaflets (90DAP)
0	121.23	14.534	71.341	6.076	2021.213
10	126.76	14.912	74.021	6.289	2080.543
20	125.79	16.877	75.482	7.197	2199.910
30	147.67	17.266	76.911	7.211	2202.023
60	145.89	17.453	79.046	7.951	2329.991
$LSD_{0.05}$	3.765	2.01	7.23	1.32	234.11

Figure 2. Treatments of *Moringa oleifera* L. at 60 DAP

Conclusion

The results from the current study has confirmed that exposure of *Moringa oleifera* to nanomaterials encouraged earlier germination. Also, the growth parameters were enhanced by the application of treatments at the 30 minutes and above treatments suggesting that lower time treatments are not effective in instigating plant response to the nanoparticles. The results of these finding have confirmed the work of other researchers as well as the manufacturers of the alpha spin nanoparticle disc, who clearly claimed that the product is effective in plant growth and development. Further studies can consider the uptake and translocation of nanoparticles by plants and the molecular mechanisms involved in the uptake by *Moringa.*

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