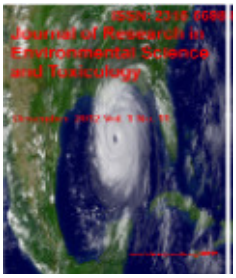

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Full Length Research Paper

Effect of biofertilizer application on growth of *Vitellaria paradoxa* seedlings

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Shea tree (*Vitellaria paradoxa* Gaertn. Family; Sapotaceae) is a medium-sized fruit tree indigenous of Sudano-sahelian zone of Africa with great economic and ecological components. However, it possesses low genetic and physiological capacity which affects growth of the species negatively. A liquid foliar fertilizer (BOOST XTRA) was used in the treatment of the seedlings to determining the effect of the biofertilizer on the seedling growth and to determine the efficacy of the use of this biofertilizer at different concentrations.28 weeks old Shea seedlings planted directly using nuts were foliar sprayed for 8 weeks. The design used was 4x2 factorial experiment in a Completely Randomised Design (CRD) with 3 replicates each. Factors include Concentrations of the biofertilizer (0.0, 0.25, 0.50 and 0.75 g/l) and Regime of the application (1 and 2 weeks). Data was analyzed statistically using Analysis of variance (ANOVA) and least significant difference was observed at 5%. Leaf chlorophyll, leaf number, number of nodes and shoot length were measured. Chlorophyll content measured indicated a significant difference among the interaction. The mean differences among the shoot length at various levels and their interactions showed no significant effect though the highest mean falls at 0.75g/l and at 2 weeks interval.

Keywords: Biofertilizer, Chlorophyll, Seedlings, Vitellaria paradoxa.

INTRODUCTION

Shea tree (*Vitellaria paradoxa* Gaertn. Family; Sapotaceae) is a small to medium-sized tree 10-15 (max. 25) m high; much branched, dense, spreading, round and conspicuously thick and corky bark which protects older trees against bush fires. Slash pale pink, secreting white latex. Leaves in dense clusters, spirally arranged at the end of stout twigs. They are covered by thick bark showing numerous leaf scars. Juvenile leaves are rust-red and pubescent, later coriaceous and dark green, shining, 12-25 cm long and 4-7 cm wide, leaf margin wavy and bent. (Hall, 1996; ICRAF, 2011).

The tree is an indigenous fruit tree of Sudano-sahelian zone of Africa that plays a very significant role in its natural range with great economic and ecological components especially in the traditional parklands systems which incorporate scattered trees on the farmlands as woodlots with annual income (Bonkoungou, 1992; Boffa, 1999). In addition to playing a major role in nutrient recycling through leaf litter fall and the root decaying, the tree nuts are also highly valued by farmers because of its fat which are sold both in local and international markets. The vegetable fat of shea nut is second in importance only to palm oil in Africa. (Bayala *et al*., 2006; Hall *et al*., 1996).

Research has shown that the tree grows in the wild despite its importance in the life of the people of the savannah zone and has remained largely undomesticated due to its long gestation period of 12 - 15 years (Opoku-Ameyau *et al,* 1996; Yeboah *et al,* 2009). The shea tree adventitious root formation has low genetic and physiological capacity, which affects its commercial production negatively (Yeboah *et al*, 2009). Research efforts to improve the vegetative propagation of this tree species has been has been difficult and inconsistent. Though rooting is achievable but the success rate is very low indeed. (Opoku-Ameyau *et al*., 1996, Yeboah *et al*., 2009, Yeboah *et al.,* 2010), However, Hartmann *et al* (1997) explain that propagation methods can be improved by considering environmental and biochemical

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factors.

Deficiencies in soil nutrients for crop production in Sudan and savanna belts of Africa especially in Nitrogen (N) and Phosphorus (P) is a common occurrence (Bado *et al*.,2006) and the impact on the indigenous trees has been rarely observed probably because little research attention is paid to woody species in these belts. However, few studies are available recently on the nutrient requirement of boosting indigenous tree seedling growth (Dianda *et al*., 2009; Yeboah *et al.,* 2009; Binkley *et al*., 2003). In order to meet the requirement of the shea tree seedlings considering the deficiency of soil nutrients in the savanna belts, the application of a liquid foliar fertilizer (BOOST XTRA) containing 20% N, 20% K and 20% P plus other trace elements in the treatment of foliar of shea seedlings at juvenile stage is aimed at determining the effect of the biofertilizer on the physiological growth of this seedling and to determine the efficacy of the use of this biofertilizer at different concentration on a woody species.

MATERIALS AND METHOD

The experiment was conducted in March, 2012 at the Crop Science Experimental Site, University of Abuja mini-campus, Gwagwalada, Abuja, Nigeria. 28 weeks old Shea seedlings planted directly using shea nuts were foliar sprayed using BOOST XTRA (foliar fertilizer complex) at different levels on a weekly interval and observations were made weekly for 8 weeks. The design was 4x2 factorial experiment in a Completely Randomised Design with 3 replicates each with Concentrations of the biofertilizer and Regime of the application as factors while level of concentration at 0.0, 0.25, 0.50 and 0.75 g/l and Intervals at 1week and 2 weeks are the sub-factors. Data was analyzed statistically using 2- way Analysis of variance (ANOVA) and least significant difference was observed at 5% level of significance using a statistical package (Genstat 10.3 Discovery edition 4). Parameters measured were leaf chlorophyll, leaf number, number of nodes and shoot length.

Leaf chlorophyll meter; The chlorophyll content measured by the chlorophyll meter, a measuring light at which red light 650nm wavelength is absorbed by chlorophyll molecules and transmitted in an infrared light, 940nm wavelength at which no absorption occurs indicating how green the leaf is and measured in SPAD-Soil Plant Analysis Development units. The instrument was calibrated before use based on the procedure of manufacturer.

Leaf number: This is the average number of leaves that was found on each shoot. They were counted manually using hand.

Number of nodes: This is the average number of buds observed on each shoot including those that possess leaves. They were counted manually using hand.

Shoot length:This is the average height of the shoot from the base to the tip at the apical node. It was measured using a metre rule calibrated in cm.

RESULTS AND DISCUSSION

The control had the highest mean ($p<0.05$) at level of concentration of the biofertilizer (Table 1) and at 2 weeks interval which indicates no significant effect but there is a significant difference among the interaction of the mean of chlorophyll content measured ($P<0.05$) (Table 2) which means the biofertilizer application had significant effect on the chlorophyll content of the species at 2 weeks interval when 0.50mg/l was applied. This concurs with the findings of Jifon *et al* (2005) that the young leaves on *Citrus spp* tree seedlings in the green house had a narrowest chlorophyll concentration range after measurement using chlorophyll content meter compare to the mature leaves on the *Citrus spp* on the field with a wider range.

The mean differences among the shoot length at various level of fertilizer treatment, application regime and their interactions showed no significant effect ($P=0.05$) though the highest mean falls at 0.75g/l and at 2 weeks interval (Table 1 and 2). Differences in shoot growth resulting from the applied nutrients can also be due to available N and K derived from the complex biofertilizer (Milosevic and Milosevic, 2009). Rengrudkij and Partida (2003) also reported that no significant in P and K on the effect of avocado seedling growth when foliar treated with fertilizer, they further explained that the availability of these elements stimulated growth and increase nutrient uptake from the soil.

Effect of the foliar biofertilizer on both the lateral and terminal buds of Shea seedlings after application showed no significance ($p<0.05$) at both the main effects interaction of the species. However, the treatments that had had the highest mean include control (0.00g/l) and at 1 week interval (Table 1). The interaction of the treatments also indicated no significance at $P<0.05$ with the mean ranging from 6.94 to 12.17. This may be as a result of the low concentration at which the biofertilizer was applied which corresponds with Tallapragada *et al* (2011) when *Capsicum annuum* was foiliar sprayed with biofertiliser, there was increase in auxiliary buds of the species compared to the azotobacter treated of the species.

Number of leaf had no significant effect ($p<0.05$)on the biofertilizer applied on the main effect and the interactions though the highest mean was observed at 0.75g/l and at interval of 1 week (Table 1) and also at 0.75g/l at 1 week interval interaction (Table 2). This showed that the influence of biofertilizer increases the foliage has the concentration increases during weekly application (Table 1). The findings correspond with El-

Table 1. The relationship between treatments means and LSD of Shea seedlings growth

Treatment	Leaf Chlorophyl (SPAD)	Shoot Length (cm)	No of Buds	No of Leaves
CONC (g/l)				
0.00	49.1	15.04	10.84	6.06
0.25	47.2	14.74	9.04	4.88
0.50	48.4	13.08	9.29	5.75
0.75	44.8	15.63	9.07	7.08
LSD	16.89	4.426	1.884	2.727
Significance	ns	ns	ns	ns
WEEKS				
1	45.2	15.01	10.17	6.90
2	49.5	14.24	8.95	4.98
LSD	11.94	3.129	1.332	1.928
Significance	ns	ns	ns	ns

SPAD- Soil Plant Analysis Development unit. *Significant at 5% level of probability, NS-Non significant.

Table 2. The relationship between treatments means, interactions and LSD of Shea seedlings growth.

TREATMENT	Leaf Chlorophyl(SPAD)	
	WEEKS	
	1	2
CONC (g/l)		
0.00	40.4[b]	57.8[b]
0.25	55.4[b]	39.0[b]
0.50	34.5[b]	62.3[a]
0.75	50.6[b]	39.1[b]
LSD		
CXW	*	

SPAD- Soil Plant Analysis Development unit. *Significant at 5% level of probability,

Khateeb *et al*. (2010) and Abbasniayzare *et al*. (2012) that treatments of biofertilizers on *Chamaedoreaelegans*and *Spathiphyllum illusion* significantly increased the number of leaves as compared with the control respectively.

Though the main treatment does not have a significant effect on the species, however the interaction showed a beneficial influence on the chlorophyll content of the leaves of *Vitellaria paradoxa* as it indicates the amount of nutrient received by the plant (from biofertilizer). It is recommended to apply biofertilizers for the positive environmental effects due to its biodegradable nature, compatibility to the plants and less prone to producing transgenic radioactive substances. So this can prevent pollution of soil and water and excessive accumulation of phosphorus and heavy metals such as cadmium and boron. We also suggest that further study should be carried out on the use of more concentration of biofertilizerfor a longer period on the species.

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