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# Effects of NPK fertilizer on the shoot growth of *Vitellaria paradoxa* C.F. Gaertn.

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**This study examined the effects of different levels of NPK fertilizer on the growth of *Vitellaria paradoxa* . Shoot height, collar diameter and leaf productions were assessed fortnightly up to the sixteenth week after transplanting. The results showed that there were no significant differences (P < 0.05) among the treatments in shoot height, collar diameter and leaf production. It was observed that shoot height of *Vitellaria paradoxa* exhibited close values ranging from 8.49 to 10.64 cm. The leaf production ranged from 6 to 10 at the end of sixteenth week of study. Different levels of NPK fertilizer applied did not have effect on collar diameter of seedlings of *V. paradoxa* during the period of study. The study has shown that application of NPK fertilizer did not have significant effects on the growth of seedlings of *V. paradoxa.* In conclusion, more effort should be employed in determining optimum quantity of mineral fertilizers required to promote the growth of *V. paradoxa* seedlings in the nurseries.**

**Key words:** *Vitellaria paradoxa,* NPK fertilizer, growth, seedlings.

## INTRODUCTION

*Vitellaria paradoxa* is an indigenous fruit tree of Sudano-Sahelian Africa, it is called shea butter tree. There are two subspecies of *V. paradoxa*, one of which (*V. paradoxa*) extends from Senegal eastwards to the Central African Republic whilst the other (*V. nilotica*) occurs in southern Sudan and Ethiopia, Uganda and northeast Zaire (Boffa, 1999). In natural range, shea butter trees are both economically and ecologically important, they are often the main component of the tree stratum in traditional parkland systems, which are farmlands with scattered trees forming an open permanent over-storey of associated annual crops (Bonkoungou, 1992). As a perennial woody species, that shed its leaves annually, it plays a major role in nutrients recycling (De Bie et al., 1998; Bayala et al., 2006). The litter of shea butter tree was shown to have lower nutrient content when compared with *Parkia biglobosa* (another common parkland non $N_2$-fixing leguminous tree), and it was found to decompose at a low rate with time (Bayala et al., 2005), suggesting a more sustainable impact on soil fertility (Bayala et al., 2006).

Furthermore, *V. paradoxa* is highly valued by farmers, mostly because of its fat containing kernels which are sold both in local and international markets, thereby considerably contributing to wealth creation. The vegetable fat of shea nut is second in importance only to palm oil in Africa (Hall, 1996). The commercialization of shea products represents an important source of income at different parts of the community chain, from community levels, with rural children and women who gather and process nuts, to town dwellers as well as entire countries (Bonkoungou, 1992; Boffa et al., 1996). For instance,

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**Table 1.** Analysis of variance for shoot height growth of *V. Paradoxa*.

| Source of variation | df | Sum of square | Mean of square | F-cal |
|---|---|---|---|---|
| Treatment | 4 | 393.71 | 98.43 | 1.77ns |
| Error | 43 | 2386.49 | 55.50 | |
| Total | 47 | 2780.20 | | |

ns = Not significant at 5% probability.

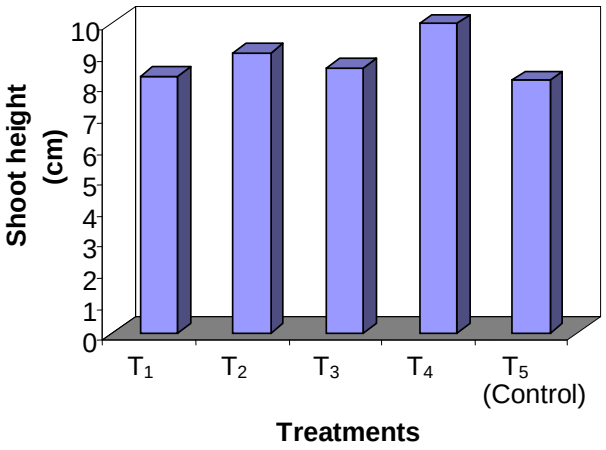


**Figure 1.** Graph showing variation in shoot height growth in relation to treatments

shea nut was the third export product of Burkina Faso in the 1980's (World Bank, 1989). Shea butter tree also provides fruits, medicine, construction materials, fuel wood and carving wood (Hall, 1996). Despite its great contributions to both local and national economies, *V. paradoxa* remains undomesticated. Shea butter trees parklands result from naturally occurring individual trees that are protected by farmers when clearing their fields, thus creating parkland systems (Boffa et al., 1996). These parklands have been reported to be degrading steadily resulting in decreasing tree density and vegetation cover as well as reduced soil fertility (Gijsbers et al., 1994; De Bie et al., 1998; Ouédraogo, 2006). This trend suggests the need to use artificial regeneration to promote this species in farmer's fields. Thus, very few studies can be found that have varied nutrients availability to assess their full potential in tree management (Sanginga et al., 1990; Karanja et al., 1999). Consequently, basic information on nutrient requirements of important indigenous tree species is not readily available, leading to lack of practical fertilizer prescription especially at the nursery stage. The practice of using NPK fertilizers separately is seen as one factor contributing to low fertilization efficiency because it always overlook the advantageous interaction that often occurs among the elements when fertilizers are incurporated in association into the soil (Teng and Timmer, 1996). Therefore, from a domestication perspective, the evaluation of NPK fertilizer appears to be important as a prerequisite for determining how the fertilizer can be managed to promote rapid growth and development in slow growing tree species.

## MATERIALS AND METHODS

Fertilizer trials were conducted to examine the effects of NPK fertilizer on the growth performance of *V. paradoxa* seedlings at the nursery stage. This study was carried out in the green house of Forestry Research Institute of Nigeria (FRIN), Ibadan. The fruits used in this study were freshly procured from Igbeti in Olorunsogo Local Government Area of Oyo State in June, 2008. They were then depulped, washed in tap water and sown in different germination trays containing different sowing medium of river sand, saw dust and topsoil each. The experimental top soil consisted of sand 88.46%, clay 7.6% and silt 3.94%. It had the following characteristics: pH 5.6, organic carbon 1.232%, total Kjeldahl nitrogen 0.106% and organic carbon matter of 2.12%.The soil was sieved with 2 mm mesh and filled into polythene pots sized 30 cm by 27 cm and weighed 6.5 kg.

Uniform seedlings of *V. paradoxa* were then transplanted into polythene pots after eight weeks of germination. The study consisted of four different levels of NPK fertilizer: 100, 200, 300, 400 mg and control. Each level representing a treatment was replicated ten times making total number of fifty seedlings. These were laid out in a completely randomized design (CRD). Watering was done once daily and weeding carried out daily. The following parameters were assessed within 16 weeks of study: shoot height, collar diameter and leaf numbers. Collected data were analysed by means of Analysis of Variance (ANOVA) while the means were separated with least significant difference (LSD).

## RESULTS

There is no significant difference in shoot height growth of *V. paradoxa* at 5% level of probability during the period of study (Table 1). This conforms to the findings of Muhammad et al. (2009) that there were no significant differences among the growth parameters of *V. paradoxa* assessed within the period of study. This is evident in Figure 1 with shoot height readings close to each others, ranging from 8.49to 10.64 cm.

Table 2 shows that the difference in leaf production among the treatments and control samples of *V. paradoxa* were not significantly different at 5% level of probability during the period of study (Table 2). Treatment 4 had the highest number of leaves of 10 followed by treatment 1 with 9, control with 8, $T_2$, 7 and the lowest value of 6 for $T_4$ (Figure 2). This does not agree with findings of Anokwu (1997) that NPK had significant effect on the leaf production of *Gmelina arborea* seedlings.

The analysis of variance (ANOVA) shows that there is no significant difference in collar diameter of *V. paradoxa* at 5% level of probability during the period of study (Table

**Table 2.** Analysis of variance for leaf production of *V. Paradoxa*.

| Source of variation | df | Sum of square | Mean of square | F-cal |
|---|---|---|---|---|
| Treatment | 4 | 32.32 | 8.08 | 1.20ns |
| Error | 43 | 288.98 | 6.72 | |
| Total | 47 | 321.31 | | |

ns = Not significant at 5% probability.

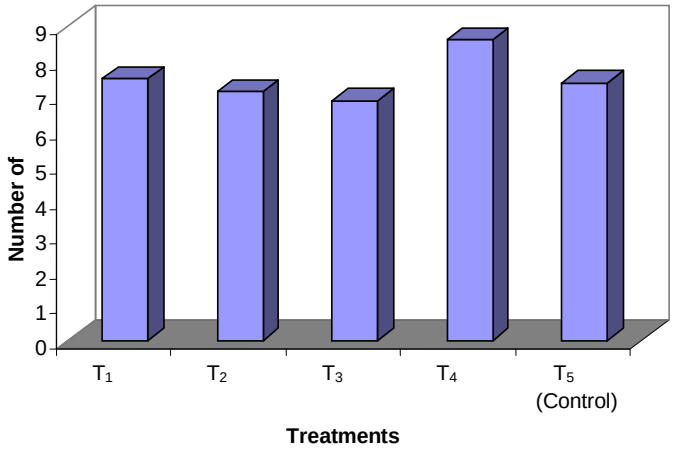


**Figure 2.** Graph showing variation in leaf production of *V. paradoxa* in relation to treatments.

**Table 3.** Analysis of variance for collar diameter of *V. Paradoxa*.

| Source of variation | df | Sum of square | Mean of square | F-cal |
|---|---|---|---|---|
| Treatment | 4 | 11.22 | 2.81 | 1.66ns |
| Error | 43 | 72.89 | 1.70 | |
| Total | 47 | 84.12 | | |

ns = not significant at 5% probability.

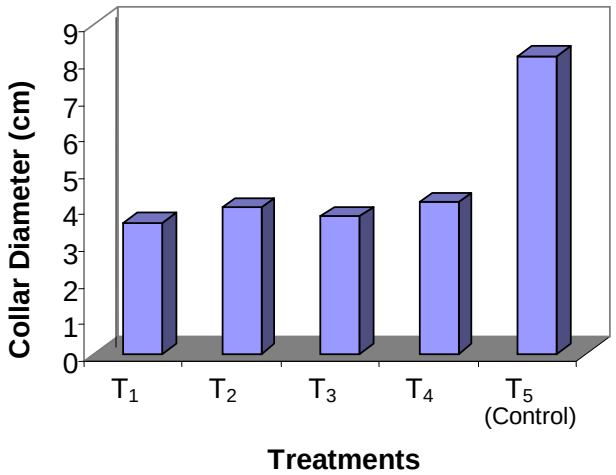


**Figure 3.** Graph showing variation in collar diameter of *V. paradoxa* in relation to treatments.

3). Figure 3 shows that different levels of NPK fertilizer applied did not have effect on the seedlings of *V. paradoxa* during the period of study as the control ($T_0$) had the highest mean collar diameter of 9.63 cm followed by $T_4$ with 4.86 cm, $T_2$ with 4.65 cm, and $T_1$ with 4.41 cm and $T_3$ with 4.34 cm. This disagrees with findings of Abdul-Raheem (2000) that NPK fertilizer vigorously enhances growth performance and development of plants.

## DISCUSSION

The results of the study showed that growth of *V. paradoxa* was not responsive to NPK fertilizer irrespective of the levels at the seedlings stage. This is shown from the data collected on shoot height growth, leaf production and collar diameter relative to non-fertilized seedlings (control). The importance of this result is that although shea butter tree is widely recognized as a

slow growing species, its inherent poor growth may be partly due to unfavourable soil nutrient status and that a higher quantity/level and other inorganic nutrients may be combined to improve the growth of *V. paradoxa*. The application of NPK fertilizers also declined collar diameter development, suggesting that NPK fertilizers had inhibiting effects that limit seedling growth at this stage. Although soil NPK were simultaneously increased by fertilizers application, but they have negative effects on the growth of species. This is in line with findings of Elliot (1994) that addition of NPK fertilizer had no effect on growth of temperate red pine at nursery stage.

Similar results have been found in other studies (Elliott and White, 1994; Davidson, 2004). Tree growth in the Amazonian forests was found to be not responsive to NPK fertilization. Baker et al. (2003) also reported the limitation in growth of *Celtis mildbraedii* due to the relative availability of nitrogen, phosphorous and potassium in valley soils in semi-deciduous tropical forest of Ghana. In our study, application of different levels of NPK fertilizer had no significant difference when compared with control treatments possibly because of sufficient soil supplies of these elements.

## Conclusion

The results of the investigation showed that application of NPK fertilizer did not have significant effects on the growth of seedlings of *V. paradoxa.* There is no evidence however that NPK had any beneficial effects on this species at seedling stage, probably because of low quantity of NPK fertilizer applied. Thus, further studies are needed to address the required quantity of NPK fertilizer for effective growth of *V. paradoxa* seedlings. The results also showed that application of the fertilizer posed to be limiting factor inhibiting the seedling's collar diameter. Therefore, from the study reported here and the very limited literature on *V. paradoxa*, it can be concluded that more effort should be employed by research scientist in determining optimum quantity of mineral fertilizers required to the promote growth of *V. paradoxa* seedlings in nurseries.

## Conflict of Interests

The author(s) have not declared any conflict of interests

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