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The effect of Fertilizer Application on the Seedling Growth of *Albizia niopoides* (Spruce Ex Benth) Barkart

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ABSTRACT: This paper assessed the effect of NPK 15-15-15 fertilizer on the growth and development of *Albizia niopoides* seedlings in this study, sterile and non sterile soils were filled into 60 pots followed b y addition of 0.5kg of NPK 15-15-15. Height, collar diameter, leaf area and leaf n umber assessments were carried out fortnightly. The treatments were (a) unsterilized soil + fertilizer (b) Sterilized soil + fertilizer (c) sterilized soil (d) unsterilized soil. The statistical design adopted was randomized complete block design (RCBD) with three replication. The stem dry matter accumulation of8.94g was highest under unsterilized soil + fertilizer. Fertilized seedlings differed significantly from unfertilized ones in their height growth as the highest value of 95.4cm was recorded under non-sterile soils with fertilizer application. Highest leaf number values of (9.1) and leaf area value (260cm^2) were obtained under fertilized soils (non-sterile). Highest number of nodules (67.50 was also produced by *A. niopoides* seedlings with fertilizer application. It is recommended that farmers should administer fertilizer to stimulate good growth and development of this species for maximum benefit.

Key Words: Shifting cultivation; sterile soil; soil fertility; fertilizer.

Introduction

As part of the effort to find a lasting solution to centuries-old shifting cultivation and Bush fallow systems, scientists developed new technologies which will not only boost food production, but also maintain ecological stability and preserve the natural resource base. These are referred to as agroforestry technologies. Majority of the trees adopted in this system are leguminous species. Because of our fragile ecosystem, some of them might require external input of inorganic fertilizer for proper establishment, because tropical soils release nutrients too slowly to meet the large needs of high producing plants (Okekunle, 2002). In afforestation projects only one or two tree species are used for simple management and uniform end product. These species may not be suited to all sites and some nutrient inputs are often necessary to aid their establishment and reduce irregularities. Stone (1990), recorded some spectacular improvements in growth in some impoverished sites when small amounts of nutrients were added. Evans (1999) observed that trees, require supplies of certain essential chemical elements for growth. Elements needed in large quantities, called macro nutrients are nitrogen (N), phosphorus (P), potassium (K), calcium

(Ca), magnesium (Mg) and sulphur (S). Skerman (1977) asserted that legumes generally would respond to dressings of P, Mo, S and in some soils, Cu and Zn. Furthermore, because legumes have the ability to acquire their needs for nitrogen symbolically, it is usually not added in the fertilizer application mixture. However, between planting the legume seed and the appearance of the first active nodules, there is hiatus during which added nitrogen may be beneficial for establishment and even during subsequent growth, modest amount of nitrogen usually gives response.

Fertilizer requirement of *A. niopoides* are lacking in literature, consequently, this study is set out to examine the influence of a compound fertilizer (NPK. 15-15-15) on the growth and development of *A. niopoides*.

Materials and Method

Soil Sterilization

Top soil was collected from the International Institute of tropical Agriculture (IITA) Ibadan, Nigeria using a terra force machine, (Ghotat and Titan date models). The sterilization process commenced by turning the valve on the top of butane gas container attached to the machine. This was followed by lighting the torch to preheat the burner coils after which the fuel valve were opened slightly, and electric motor switched onto warm up the burner coil for at least 6 minutes. The machine continued in this way for another 15 minutes to enable pumping of paraffin into burner coils. Later the valves were slightly opened again. This produced a whole vapour which when ignited caused a gradual increase of the flame required to heat the soil. Soil samples were later fed regularly and steadily into the machine for sterilization until they were completely dried.

Experimental Design

Approximately 2.9kg of the sterilized soil was filed into 60 type pots. (2.5cm by 7.5cm). Unsterilized top soil was filled into another batch of 60 pots. This was followed by the addition of 0.5g of NPK 15-15-15 inorganic fertilizer into each pot which was mixed thoroughly with the soils (sterilized & unsterilized) and left for two weeks to equilibrate. Late, four weeks old seedlings of *Albizia niopoides* were transplanted into all the pots which were arranged in a Randomized Complete B lock Design (RCBD) with three replications. They were watered twice daily.

Plant height, collar diameter, leaf number and leaf area assessments were carried out every 2 weeks. The collar diameter was measured with venier caliper while height and leaf number were assessed with meter rule. The biomass production was determined by harvesting the leaves, stems and roots separately, and oven dried for 48 hours at 80^{o}C at which time the moisture was reduced to the barest minimum. The leaf area was determined graphically according to the method of Edje and Osini (1987). Twenty-four weeks after transplanting (WAP), the tops and roots of the seedling were harvested with the aid of secateur and nodule number assed. Nodule number was determined by first removing the seedlings with the soil from the experimental pot. This was then transferred into a wheelbarrow filled with water to facilitate removal of the soil… this was done gently to avoid destroying the rot with the nodules until the soil was completely removed. The seedling were later immersed in a clean water in a bucket after which the nodules became visible for counting.

Results and Discussion

The result obtained in the second week with respect to plant height indicated a significant difference between fertilized and unfertilized soil. However, unsterilized soil without fertilizer exhibited greater height growth of 17.9cm. This trend persisted till the fourth week. The results obtained by other authors on the beneficial effects of various fertilizer elements on tree growth such as N (Amold and Diest, 1991, Ca, Mg, and K,) Hendershot, 1991) agree with the finding in this study (Fig 1).

Table 2: Mean dry weight values of growth parameter as affected by fertilizer treatments.

Treatments	Dry weight (g)
Unsterilized soil + fertilizer	8.92a
Sterilized soil + fertilizer	6.54a
Sterilized soil	5.82b
Unsterilized soil	4.63b

Means with the same letters are not significantly different at $\alpha = 0.05$

Table 3: Mean nodule number of Albizia niopoidsa s affected by fertilizer application

Treatments	Dry weight (g)
Unsterilized soil + fertilizer	67.7a
Sterilized soil + fertilizer	64.0a
Sterilized soil	18.5b
Unsterilized soil	5.30b

Means with the same letters are not significantly different at $\alpha = 0.05$

At the eight week, non-sterilize and sterile soil with fertilizer gave 28.6cm and 26.4cm respectively. These insignificant responses to fertilizer application common to sterilized and unsterilized soils continued for 18 weeks after planting. Thecontrol treatment, which was sterilized soil without fertilizer application yielded the least height growth of 48.3cm while unsterilized soil lacking fertilizer gave 54.3cm at 4 WAP, however the unfertilized soil did not differ significantly from the fertilized ones in the (height growth). This according to Yong (1990), could be de to the ability of *A. niopoides* to efficiently fix nitrogen as a result of the symbiotic relationship between its nodules and rhizobium bacteria. *A. niopoides* in this study was discovered to start nodulating about 4 weeks after planting. Young (1997), opined that woody species such as *A. niopoides* are in most cases more or less constant cycle of root nodules turnover.

There was insignificant differences in diameter increment among the treatments at five weeks after planting. In all the treatments, the highest value of 0.40cm was recorded under unsterilized soil with fertilizer. At 12WAP, the two unfertilized soil gave similar diameter values of 0.47cm from the 14th to 18th weeks after planting, a particular trend was observed in which there was no significant difference among the treatment except between the fertilized and unfertilized topsoil. These results suggested a stipulating effect of fertilizer on diameter growth. This was also supported by the observation that highest growth is achieved when frequent top dressing of soluble fertilizers are made once seedlings have passed the cotyledon stage (Evans, 1999).

Although leaf numbers responded positively to fertilizer application yet no significant difference was observed among the treatments in the first 6 weeks after planting. The mean values is increased from 6.2 to 6.4 in week two, to 8.1 and 9.1 in week . This could be due to the nitrogen fixed by the species as also observed by Newton and Burgess (1983). They reported that although many factors such as climate, plant strain, herbicides and pesticides influence agricultural productivity, total dependence rests on photosynthesis and supply of inorganic nutrients. According to them, the essential nutrient most often limiting in crop productivity is combined or “fixed” nitrogen which in this study was perhaps contributed by *A. niopoides*.

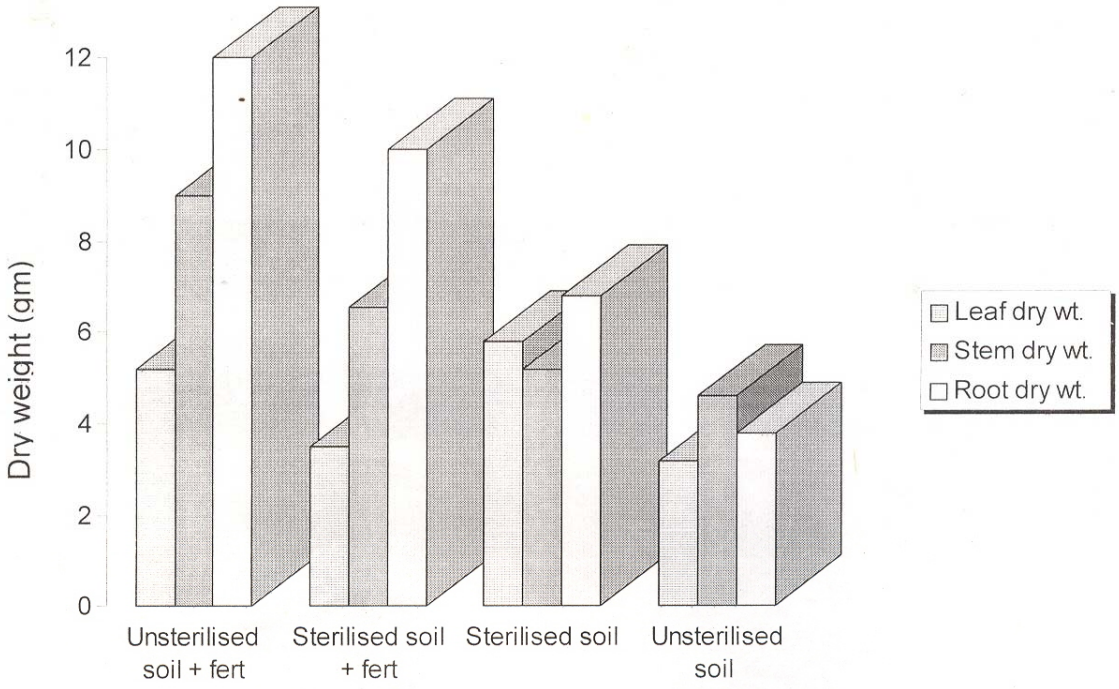


Fig. 2: Effect of various fertilizer treatments in dry matter accumulation of *A. niopoides*

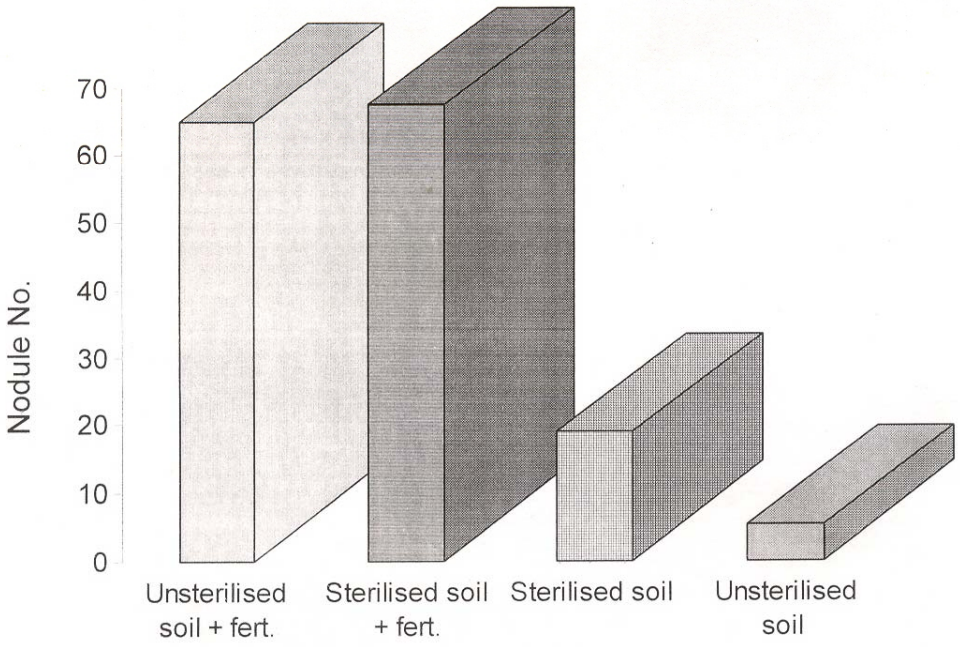
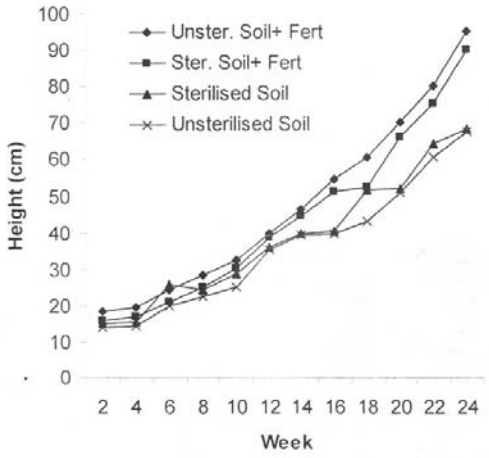
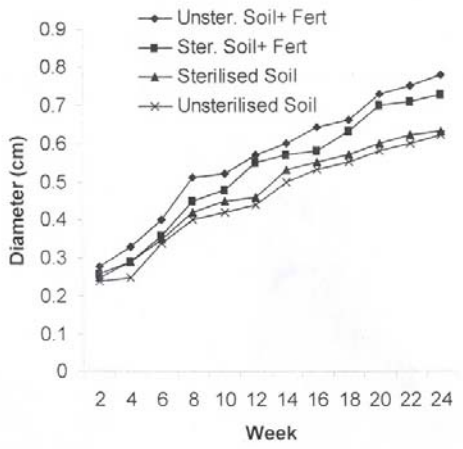


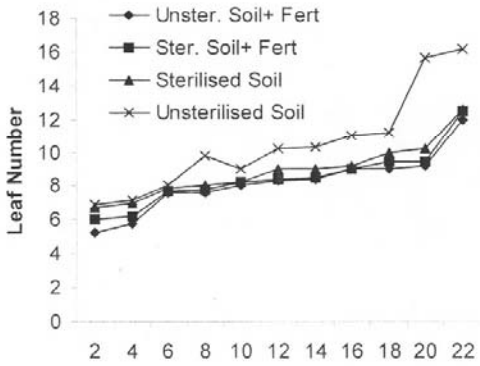
Fig. 3: Nodule production by *A. niopoides* under different treatments



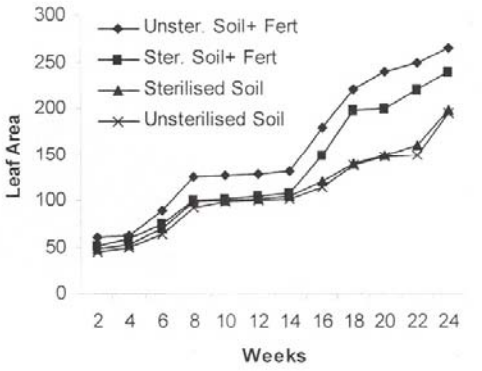
Response of height of *Albizia niopoides* seedlings to fertilizer treatments



Response of diameter of *Albizia niopoides* seedlings to fertilizer treatments



Response of leaf number of *Albizia niopoides* seedlings to fertilizer treatments



Response of leaf area of *Albizia niopoides* seedlings to fertilizer treatments

Fig. 4 Mean values of maize growth parameters as affected by fertilizer application

The findings in terms of leaf area indicated that fertilized soil gave higher value than the rest of the treatments which was probably a reflection of more nutrients made available to the seedlings by the fertilizer. *Albizia niopoides* seedling with fertilizer application produced highest number of nodules with mean value of 67.5. However, the difference was not significant when compared with sterilized soil containing fertilizer..

The lowest mean value of 5.3 was recorded for *Albizia niopoides* seedlings grown on sterile soils that were not subjected to any fertilizer treatments nitrogen is a key element required for plant growth, and the symptoms of N-deficiency range from poor yields to crop failures. In Africa, this deficiency has been corrected by application of fertilizer. Presently, the cost of fertilizer has gone beyond the reach of an average local farmer. However, there are some plant species that are capable of utilizing atmospheric nitrogen for growth. These species are legumes of which *A. niopoides* is one. Their advantages rest solely on their ability to produce fix nitrogen. The insignificant differences experience in this study could have been due to these nodules (Fig. 3). The stem dry matter accumulation was higher in unsterilized soils and soil with applied fertilizer having 8.91g and 6.54g respectively, this explains further the role of fertilizer on seedlings growth (Fig 2).

Conclusion

The results revealed a beneficial effect of fertilizer on the overall development of seedlings. This is an indication that farmers in the humid low land region of the tropics may need to administer fertilizer for rapid establishment of this species. This is all the more important considering the fragmentation of land coupled with fertility depletion of some tropical soils due to developmental activities. However, some significant response recorded among the treatments suggest t hat this specie could survive in an infertile soil which implies that where inorganic fertilizers are lacking or beyond the reach of the farmers, the performance of this species could still be encouraging.

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