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# Performance of *Acacia senegal* (L.) Wild Seedlings Growth under some Tree Manures and NPK Fertilizers in Nursery Site

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## Abstract

This study aimed to assess the effects of tree manures in comparison with NPK fertilizer on growth of *Acacia senegal* seedlings. It was conducted in the nursery of the Faculty of Forestry, University of Khartoum, Shambat (Lat.: 15° 39′ 387″ N and Long.: 32° 30′ 871″ E), during August 2008 and January 2009. The growing media were prepared by mixing ground foliage of trees with sandy soil (weight/volume) as follows, *Albizia lebbeck* (AL): 25 g, 50 g and 75 g; *Azadirachta indica* (AZ): 25 g, 50 g and 75 g; *Khaya senegalensis* (KH): 25 g, 50 g and 75 g; NPK fertilizer: 30 g per seedling. *Albizia lebbeck* and *Azadirachta indica* manures and NPK fertilizer have stimulated the *Acacia senegal* seed germination percentage in comparison with the control, with respective values of 89, 82.7, 81 and 71%. *Khaya senegalensis* manure has suppressed the *Acacia senegal* seed germination percentage with a value of only 49%. Effects of treatments on the seedlings growth parameters varied in the following percentages, in comparison to the control, shoot height: AZ 62.9%, AL 46%, KH 9.9% and NPK 27.8%; root length: AZ 25.8%, AL 31.5%, KH 30.6% and NPK 4.4%; diameter: AZ 75.2%, AL 37.1%, KH 34.3% and NPK 20%; Shoot biomass: AZ 319%, AL 195.2%, KH 57.1% and NPK 42.9%; root biomass: AZ 288.9%, AL 116.7%, KH 55.6% and NPK 16.7%%;. Thus, the effectiveness of the used substrates on the growth performance of *Acacia senegal* seedlings occurred in the following descending order: *Azadirachta indica*> *Albizia lebbeck*> *Khaya senegalensis*>NPK fertilizer. These results assert clearly the ameliorative and fertilizing characteristics of tree manures that can be reliably used for raising seedlings stocks in the nurseries.

**Key Words:** tree manure, NPK fertilizer, sandy soil, *Acacia senegal* seedlings

## Introduction

Trees are known to contribute in ameliorating the soil conditions and replenishing nutrients to crops. Trees and forests accumulate organic matter and nutrients within their ecosystems through biogeochemical cycling, capturing atmospherical depositions and biological fixation. Through the biogeochemical mechanism, trees are capable to cycle and immobilize huge amounts of nutrients in their biomass and the solum (Montagnini et al. 2000; Young 2002; Deans et al. 2003; Harmand et al. 2004; Laclau et al. 2010; Carnol and Bazgir 2013). However, much of the nutrients immobilized in the woody biomass are not readily available, and would be sequestered until the end of the tree revolution age or exploitation by the human being. The most dynamic part of the tree biomass is the litter, constituted mainly from dead foliage and roots that is turned-over annually (Nair 1993; Mafongoya et al. 1998; Bot and Benites 2005; Xiaogai

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et al. 2013). Annual litter fall in tropical forests ecosystems may amount to 10-15 tons $ha^{-1}yr^{-1}$ (Duchaufour 1984; NAP 1992; Muoghalu et al. 1993; Descheemaeker et al. 2006).

Tree manure (biomass) can be incorporated into exploitable systems such as agroforestry, either naturally or artificially. It can be collected, transformed and transferred to other utilization practices such as farms, orchards and nurseries (Rao and Mathuva 2000; Mandal et al. 2003; Schroth and Sinclair 2003; Sangakkara et al. 2004). The choice for manure quality will depend on the utilization strategy, whether quick or slow decomposing substances is needed (Bot and Benites 2005; Mubarak et al. 2008). Usually, tree manure has sufficient nutrients to satisfy the crop requirements of the basic elements. In addition, the tree manure is considered a clean source of nutrients to the terrestrial ecosystems, i.e. it is environmentally friendly (Eghball et al. 2004). Nevertheless, some inconveniences may arise when using fresh forms of tree biomass, from being allelopathic to crops and from harboring diseases and pests (Khan et al. 1999; Uddin et al. 2007; Zeng et al. 2008; Whiting et al. 2009).

One of the great concerns in raising and producing sturdy and healthy nursery stocks is the choice and usage of seedlings growing media. Growing media functions can include, availing sufficient water and nutrients to the seedlings and assuring support and space to their growth (Landis 1990; Miller and Jones 1995). The tree subjected to bioassay test in this study was *Acacia senegal* (L.) Wild. *Acacia senegal* is one of the main tree species that produces gum Arabic that constitutes a source of income for the Sudan and other African countries. Thus, research on regeneration and growth of this species are needed to assure adequate establishment in the field, in which conditions are becoming more precarious due to natural and anthropogenic factors. On the other hand, the choice of tree manures used was based on the presence of the species (*Albizia lebbeck* (L.) Benth., *Azadirachta indica* A. Juss. and *Khaya senegalensis* (Des.) A. Juss.). *Khaya senegalensis* (Des.) A. Juss. is indigenous to Sudan, while *Albizia lebbeck* (L.) Benth. and *Azadirachta indica* A. Juss. are exotics but almost naturalized since their introduction in the early $20^{th}$ century (El Amin 1990).

This study aimed: to assess the effects of some tree manures, viz *Albizia lebbeck*, *Azadirachta indica* and *Khaya senegalensis* on regeneration and growth of *Acacia senegal* seedlings in nursery mixtures with sandy soil and in comparison with NPK fertilizer; to screen the appropriate tree manures and the adequate doses suitable for good nursery stock raising.

## Materials and Methods

The study was conducted in the nursery of the Faculty of Forestry, University of Khartoum, Shambat, on the eastern bank of the Nile River (Lat.: $15^o$ 39′ 387″ N and Long.: $32^o$ 30′ 871″ E).

*Acacia senegal* was chosen for the bioassay test to tree manure and NPK fertilizer. its seeds were procured from the Tree Seed Center, Forestry Research Center, Khartoum. The seeds were delivered deliberately pretreated by conc. $H_2SO_4$ for 30 minutes to break seed-coat dormancy and to enhance germination. The containers for nursery stock raising consisted of black cylindrical polythene bags (15x25 cm, flat), sealed at one end, and perforated to their third length; they were acquired from the local market. The growing media ingredients consisted of sandy soil and tree manures from Shambat area and NPK fertilizer (17-17-17) acquired from the local market. The tree manures were prepared from air-dried and ground foliage ($\phi$=0.5 mm) of *Azadirachta indica*, *Albizia lebbeck* and *Khaya senegalensis* trees. The fresh foliage was collected from different trees (5 for each species and at various positions on the crowns).

Tree manures were thoroughly mixed with the sandy soil and then packed in the polythene bags. Three doses of 25, 50 and 75 g from each tree manure type were chosen. The NPK fertilizer was added in five doses of 6 g per month (30 g in total) during the experimentation period, lest that the stuff might cause burning to the seedlings. Each treatment was replicated for 25 times, in order to withdraw 5 bags (seedlings) monthly and thus the total prepared bags were 275. The bags were arranged in the nursery beds in a randomized complete block design. The resulting treatments were: 1/ Control: sandy soil without any addition; 2/ NPK: with addition of 6 g per month per bag; 3/ AL1: with addition of 25 g of ground *Albizia lebbeck* foliage powder; 4/ AL2: with addition of 50 g of ground *Albizia lebbeck* foliage powder; 5/ AL3: with addition of 75 g of ground *Albizia lebbeck* foliage powder; 6/ AZ1: with addition of 25 g of ground *Azadirachta indica* foliage powder; 7/ AZ2: with addition of 50 g of ground *Azadirachta indica* foliage powder; 8/ AZ3: with addition of 75 g of ground *Azadirachta indica* foliage powder; 9/ KH1: with addition of 25 g of ground *Khaya senegalensis* foliage powder; 10/ KH2: with addition of 50 g of ground *Khaya senegalensis* foliage powder; 11/ KH3: with addition of 75 g of ground *Khaya senegalensis* foliage powder.

*Acacia senegal* seeds were sown on 28$^{th}$ August 2008 directly in the prepared polythene bags (2 to 3 seeds per bag) and thinly covered with own substrate. Watering (tap water) was done once every two days over the experiment period. Other silvicultural operations including weeding, seedling lifting and root cutting were carried out as routinely run in the forest nurseries. The seedlings were later thinned to one plant per polythene bag. Monitoring of nursery trials lasted for 5 months. Growth parameters measurements started after one month from sowing date, the parameters measured monthly were: shoot length; shoot diameter; root length and shoot and root biomasses.

Soil and tree manures physicochemical determinations in the laboratory were carried out according to the international procedures (Klute 1986; Kalra 1998). Air-dried composite-samples of soils and tree manure (mixture of 3 samples) were used to analyze particle size distribution, bulk density, pH, electrical conductivity (Ec.), soluble cations (Ca, Mg, Na and K), Nitrogen, Phosphorous and organic carbon.

Data from intermediate readings of growth parameters were processed by excel software and presented into temporal variation curves. While the final measurements of the growth parameters were subjected to analysis of variance by SAS program (SAS 1990) and the significant differences between the means of the treatments were assigned according to Duncan Multiple Range Test.

## Results

### Characterization of the growth media (soil and tree manures) and seed germination

The particle size distribution of the soil used was predominated by sand (68.7%), whereas silt and clay contents were successively 11.1% and 20.2%, therefore the soil texture class was sandy. The soil reaction was slightly acidic (pH 6.8). The soil was also non-saline and non-sodic, with Ece of 0.4 $dSm^{-1}$ and SAR of 2.2, respectively. It had low contents of exchangeable cations: 3.5 $mmoll^{-1}$ Ca+Mg, 2.5 $mmoll^{-1}$ K and 2.5 $mmoll^{-1}$ Na. The organic carbon, total nitrogen and available phosphorus contents of the soil were also very low with values of 0.1%, 0.01% and 2.7 ppm, respectively.

The tree manures used in this study have similar contents of organic carbon and organic matter. *Albizia lebbeck* and *Azadirachta indica* have higher protein and nitrogen contents than *Khaya senegalensis*, with magnitude values of more than 2 folds (Table 1). Carbon to nitrogen ratio (C/N) values in *Albizia lebbeck* and *Azadirachta indica* manures were similar and can be categorized as medium range values. Nevertheless, C/N ratio in *Khaya senegalensis* manure was about 2 folds of that in the other tree manures and can be allocated in the higher range values of this index. No great differences were found in the calcium and magnesium contents in the manures of these trees. Even though, potassium and phosphorus contents in *Albizia lebbeck* and *Azadirachta indica* manures were slightly higher than that of their respective values of *Khaya senegalensis* manure.

*Acacia senegal* seeds were directly sown in the different types of growing media. It was found that the highest germination has occurred in the media containing *Albizia lebbeck* manure with average germination percentage of 89%. The next highest germination occurred in the media with

**Table 1.** Chemical characterization of manures of *Albizia lebbeck*, *Azadirachta indica* and *Khaya senegalensis* tree species

| Tree species | OC† (%) | OM‡ (%) | Protein (%) | N (%) | C/N | Ca (%) | Mg (%) | K (%) | P (%) |
|---|---|---|---|---|---|---|---|---|---|
| *Albizia lebbeck* | 47.7 | 95.4 | 20.5 | 3.3 | 14.5 | 2.1 | 0.8 | 2.0 | 1.1 |
| *Azadirachta indica* | 48.2 | 96.4 | 19.8 | 3.7 | 13.0 | 2.4 | 0.6 | 2.4 | 1.1 |
| *Khaya senegalensis* | 48.5 | 97.0 | 9.1 | 1.5 | 32.0 | 2.5 | 0.6 | 0.9 | 0.8 |

†OC, organic carbon; ‡OM, organic matter.

*Azadirachta indica* manure with average value of 82.7%. *Acacia senegal* seed germination values in NPK fertilizer and the control averaged to 81% and 72%, respectively. The media containing *Khaya senegalensis* manure induced the lowest germination percentages, with mean value of only 49%.

### *Temporal growth variation of Acacia senegal seedlings as affected by tree manures and NPK fertilizer*

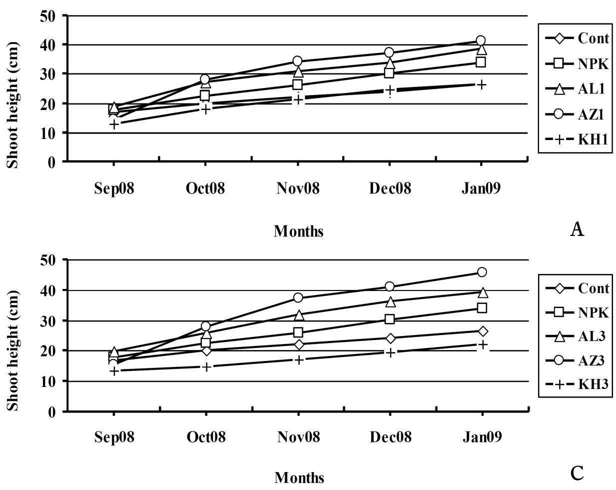
A) Shoot height: Comparison between the control, NPK and the tree manure doses of 25 g has shown that, *Acacia senegal* seedlings had similar average heights (Fig. 1A) at the initial measurements in September 2008. However, there after a great divergence occurred in the seedlings shoot height growth in the various treatments. *Azadirachta indica* and *Albizia lebbeck* manures have induced strong shoot height growth of the seedlings, which continued with strong vigor and high mean increments (6 cm per month). Shoot height growth in these treatments was sustained at upper parallel level to that in NPK fertilizer. Seedlings height growth in the control and *Khaya senegalensis* manure became identical as from the third month onwards and demurred at the lower parallel level compared to the other treatments.

Comparison between the control, NPK and the 50 g doses of tree manures has revealed approximately similar pattern of the seedlings shoot heights as pointed out for the 25 g dose of tree manures (Fig. 1B). The major exception was that mean seedlings shoot height in the *Khaya senegalensis* manure was less than that in the control and persisted at the lower parallel level through out the monitoring period.

Comparison between the control, NPK and the 75 g doses of tree manures has shown that the shoot height was almost identical to that outlined for the 50 g tree manures. In addition, there was distinct divergence in the shoot height growth trend between all the treatments (Fig. 1C).

B) Root length: Root lengths of *Acacia senegal* seedlings in 25 g doses of tree manures and NPK fertilizer were very close to each other at the commencement of measurements (September 2008). There after, root length growth in *Khaya senegalensis* manure increased with strong vigor, with 6 cm average increment per month, and passed at the upper parallel echelon line to the rest of the treatments (Fig. 2A). Root length growth in *Azadirachta indica* and *Albizia lebbeck* manures occurred at the lower parallel level to that of the above-mentioned treatment and had almost identical values, particularly from October 2008 onwards. Root length growth in the control and NPK fertilizer was almost identical during the monitoring period and was the lowest in comparison to the other treatments.

The comparison between the 50 g doses of tree manures with the control and NPK fertilizer showed that the tree manures have induced stronger root length growth than the NPK fertilizer and the control (Fig. 2B). Root length growth in *Albizia lebbeck* and *Azadirachta indica* manures went on with sustained increasing increment ever since the



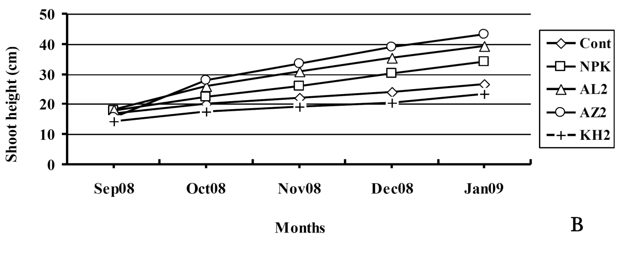
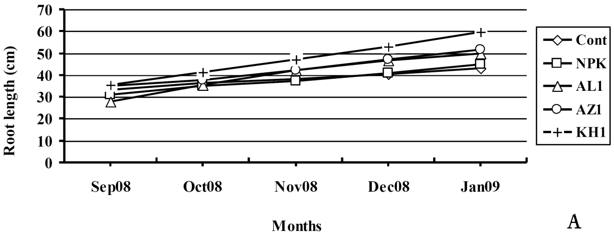
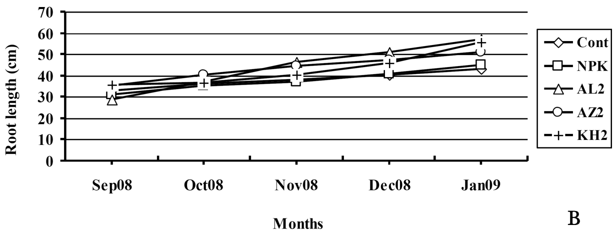




**Fig. 1.** Comparison of *Acacia senegal* seedlings' shoot growth variation in the control (Cont), NPK fertilizer (NPK) and tree manures of *Albizia lebbeck* (AL), *Azadirachta indica* (AZ) and *Khaya senegalensis* (KH). (A), (B) and (C) designate tree manure application doses of 25, 50 and 75 grams.



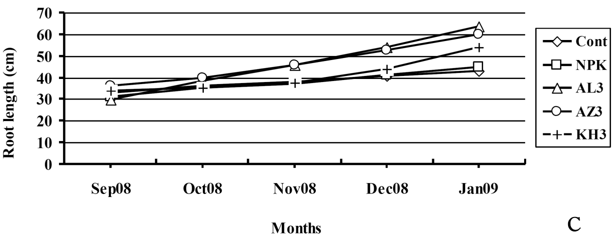




**Fig. 2.** Comparison of *Acacia senegal* seedlings' root growth variation in the control (Cont), NPK fertilizer (NPK) and tree manures of *Albizia lebbeck* (AL), *Azadirachta indica* (AZ) and *Khaya senegalensis* (KH). (A), (B) and (C) designate tree manure application doses of 25, 50 and 75 grams.

start of measurements. Root growth in *Khaya senegalensis* manure was less strong than in the two other manure types during the first months of observations. Nevertheless, in the latter months (November on wards) growth resumed with very strong rate so that in January the root lengths became very similar to the rest of tree manures. In the NPK fertilizer and the control root lengths of the *Acacia senegal* seedlings had almost identical values and occurred at the lower rate to the other treatments.

The comparison between the control and NPK fertilizer with 75 g doses of tree manures (Fig. 2C), revealed that root length growth patterns in the various treatments was very much similar to that illustrated in the Fig. 2B. The major deviation from this pattern was that root length growth rate in *Khaya senegalensis* manure was less strong and did not reach the values attained by the other tree manure treatments.

C) Diameter: Diameter growth performance of *Acacia senegal* seedlings in 25 g doses of tree manures and NPK fertilizer has shown that, the seedlings had nearly the same average diameter value in September 2008. There after, diameter growth rate began to diverge out (Fig. 3A). Diameter growth in the *Azadirachta indica* manure was the strongest, that in the control was the weakest and that in the other treatments occurred in a mid-way rate.

In the two other sets of comparison between the control, NPK fertilizer and the 50 and 75 g doses of tree manures (Figs. 3B and 3C), the seedlings diameter growth pattern was very much similar. The general trend was that, diameter growth rate in *Azadirachta indica* manures was higher than in the rest of the other treatments; meanwhile, the control induced persistently the lowest diameter growth rates.

### *Final growth parameter values of Acacia senegal seedlings*

The performance of *Acacia senegal* seedlings growth in the different growing media has shown the highest shoot lengths were recorded in media containing *Azadirachta indica* manures and which were significantly different ($p \leq 0.05$) from most of the other growing media types (Table 2). The second best performance of the seedlings shoot height growth was detected in *Albizia lebbeck* manures and which were significantly different from values pertaining to *Khaya senegalensis* manures and the control. The performance of seedlings shoot heights in NPK fertilizer and the control followed in the third and fourth places, respectively. *Khaya senegalensis* manures induced the shortest seedlings shoot heights. The growth vigor of tree manures on *Acacia senegal* seedlings shoot heights increased with increasing application doses; this trend was depicted by augmentation in the case of *Azadirachta indica* and *Albizia lebbeck* and diminution in the case of *Khaya senegalensis* manure.

All the types of tree manures used have induced the *Acacia senegal* seedlings root length growth with equal vigor. Root lengths in these treatments were invariably greater than that of NPK fertilizer and the control. The mean root length difference between the tree manure treatments and

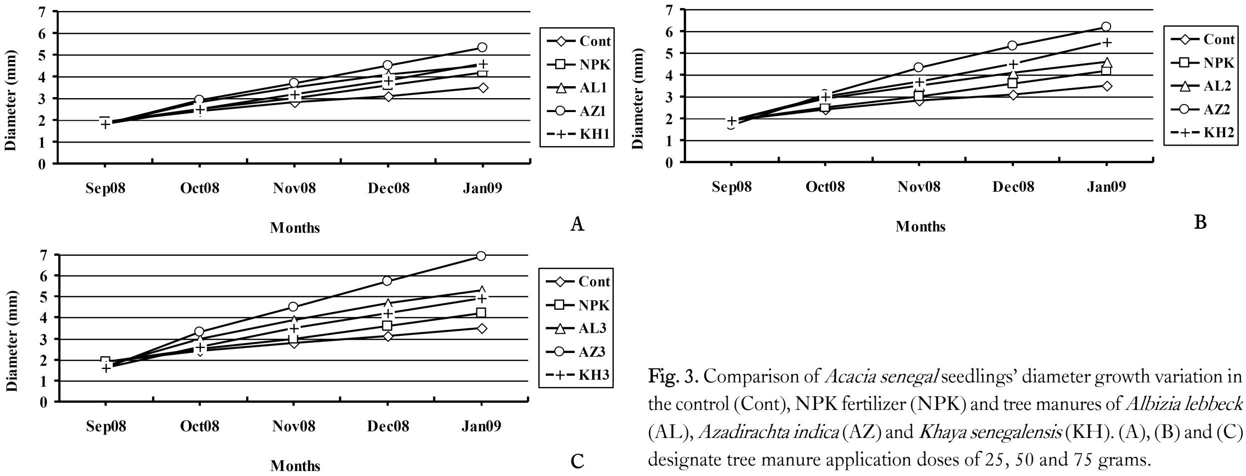



**Fig. 3.** Comparison of *Acacia senegal* seedlings' diameter growth variation in the control (Cont), NPK fertilizer (NPK) and tree manures of *Albizia lebbeck* (AL), *Azadirachta indica* (AZ) and *Khaya senegalensis* (KH). (A), (B) and (C) designate tree manure application doses of 25, 50 and 75 grams.

**Table 2.** *Acacia senegal* seedlings growth parameters as affected by tree manures and NPK fertilizer in mixtures with sandy soil

| Treatments‡ | Shoot height (cm) | Root length (cm) | Shoot/Root length ratio | Diameter (mm) | Shoot biomass (g) | Root biomass (g) | Shoot/Root biomass ratio |
|---|---|---|---|---|---|---|---|
| Control | 26.6cd | 43.1a | 0.6 | 3.5d | 0.7d | 0.6d | 1.2 |
| NPK | 34.0bc | 45.0a | 0.8 | 4.2c | 1.0d | 0.7cd | 1.4 |
| AL1 | 38.ab | 49.6a | 0.8 | 4.5c | 1.7c | 1.0cd | 1.7 |
| AL2 | 39.2ab | 56.8a | 0.7 | 4.6c | 2.0b | 1.2c | 1.7 |
| AL3 | 39.3ab | 63.6a | 0.6 | 5.3b | 2.5b | 1.7b | 1.5 |
| AZ1 | 41.1ab | 51.5a | 0.8 | 5.3b | 2.2b | 2.1ab | 1.0 |
| AZ2 | 43.3a | 51.2a | 0.8 | 6.2a | 3.1a | 2.4a | 1.3 |
| AZ3 | 45.6a | 59.9a | 0.8 | 6.9a | 3.5a | 2.5a | 1.4 |
| KH1 | 26.6cd | 59.5a | 0.4 | 4.6c | 0.8d | 0.9cd | 0.9 |
| KH2 | 23.3d | 55.5a | 0.4 | 4.6c | 1.2c | 1.1c | 1.1 |
| KH3 | 22.0d | 53.9a | 0.4 | 4.9bc | 1.3c | 0.8cd | 1.6 |

‡Control (zero addition); NPK fertilizer (addition of 30 g); AL, *Albizia lebbeck*; AZ, *Azadirachta indica* and KH, *Khaya senegalensis*; 1, 2 and 3 correspond to 25, 50 and 75 g of tree manues. Values in the column followed by different letter (s) are significantly different at $p < 0.05$.

the control reached to about 12.6 cm; however, no significant differences ($p > 0.05$) were found between all the treatments. The shoot/root length ratio values were very close to each other in all the treatments, averaging to 0.7, except in the *Khaya senegalensis* manures where the average ratio value was 0.4.

*Azadirachta indica* manures and the highest manure dose from *Albizia lebbeck* have induced the greatest increase in the *Acacia senegal* seedlings diameter, with average value of 6 mm, and which was significantly different from the other treatments. *Albizia lebbeck* (the small and medium doses), *Khaya senegalensis* manures and NPK fertilizer have produced the next greater diameter size of the seedlings and that was significantly different from the rest of the treatments. The smallest seedlings diameter size was found in the control and that was significantly different from the other treatments.

*Azadirachta indica* manures, particularly the medium and the higher doses have produced the biggest shoot biomass, and which was significantly different from the other treatments. *Albizia lebbeck* manures yielded the second bigger shoot biomass. *Khaya senegalensis* manures came in the third place in increasing the shoot biomass. Then in the last rank in increasing the seedlings shoot biomass were the NPK fertilizer and the control treatments, and that were significantly different from many other treatments.

The various tree manures and NPK fertilizer have affected the growth of the root biomass in a pattern very similar to that outlined for the shoot biomass. Thus, the root biomass values have varied in the following descending order: *Azadirachta indica* > *Abizia lebbeck* > *Khaya senegalensis* > NPK fertilizer > control. The shoot/root biomass ratios were generally above unity, but they did not show a definite trend of variation in the different categories of amendment or fertilizer applications.

## Discussion

The contents of protein, N, P, K and organic carbon in the *Khaya senegalensis* manure are lower than that in the *Azadirachta indica* and *Albizia lebbeck* tree manures. Organic carbon contents in these tree species are similar to what is observed in leguminous tree species by Roy et al. (2006). C/N ratios in *Albizia lebbeck* and *Azadirachta indica* are low (15) denoting rich manure, which should decompose readily. Nevertheless, C/N ratio in *Khaya senegalensis* is twice higher than that in the precedent species, which implies that the foliage of this species is of acidic type (with high contents of polyphenols) which would not decompose easily and may tend to accumulate.

*Acacia senegal* seed germination percentage was higher in the tree manure, particularly in the media containing *Albizia lebbeck* and *Azadirachta indica* manures and NPK fertilizer when compared with the control. Seed germination percentages in *Khaya senegalensis* were the lowest to all other media. The higher germination percentages recorded in the media of *Albizia lebbeck* and *Azadirachta indica* manures could be attributed, partly, to the fact that tree manure when mixed with sandy soil tends to ameliorate the media structure and its bulk density, increases aeration and water holding capacity that should eventually stimulate germination conditions. This observation is in agreement with works of many researchers (Önemli 2004; Sangakkara et al. 2004; Bot and Benites 2005; Kung'u et al. 2008) who found that different forms and compounds of organic matter (humic and fulvic substances, compost, rice straw and fresh *Gliricidia spp.* Leaves…etc) have stimulated and improved seed germination of various plant species. Even though, *Khaya senegalensis* manure did not stimulate *Acacia senegal* seeds germination with the same vigor as the other tested tree manures. This might be attributed a phenomenon observed by many authors (Magdoff and van Es 2000; Kung'u et al. 2008; Mubarak et al. 2009) in which some types of organic matters are known to suppress seed germination through a process generally termed as allelopathic effects; through which phytotoxic compounds damage or inhibit seed germination of many plant species.

The summary of results of the effects of tree manures and NPK fertilization on the growth of *A. senegcal* seedlings has shown that the performance of the various treatments were as follows: *Azadirachta indica* (AZ) < *Albizia lebbeck* (AL) < *Khaya senegalensis* (KH) < NPK < control (Cont). It is remarkable that the performance of *Acacia senegal* seedlings growth parameters was vigorous in the tree manures media, particularly, that of *Azadirachta indica* and *Albizia lebbeck* of all application doses and that the seedlings growth stimulation in the NPK fertilizer was relatively mediocre. The stimulation of *Acacia senegal* seedlings growth by these tree manure substrates was due to their amelioration of the physicochemical conditions of the growing media. This indicates that, the manures of these tree species are easily decomposable and release plenty of nutrients, and in addition to the organic matter that amends the media and nourish the seedlings, these observations are in agreement to reports in the literature by several researchers (Mafongoya et al. 1998; Giller 2001; Young 2002; Mandal et al. 2003; Schroth and Sinclair 2003). Besides, manure of *Azadirachta indica* is known to act as pest and disease control, which is shown by many workers (NAP 1992; Agyarko et al. 2005; Mordue et al. 2005; Helmy et al. 2007; Solomon et al 2008), and thus helping to create healthy growing environment for the seedlings. The weak effects induced by the soluble NPK fertilizer on the *Acacia senegal* seedlings growth parameters might be attributed to the loss of nutrients from the porous sand media by irrigation water and hence the seedlings could have less available nutrients to absorb.

The low growth of *Acacia senegal* (except the root growth) observed in the media amended with KH tree manure in comparison to the other tree manures could be due to poor nutrient contents in this material and reduced decomposition rate due to high C/N ratio, and this in agreement with reports by Bot and Benites (2005) and Roy et al. (2006). More over, the seedlings growth might has been affected by high lignin and polyphenols in the KH manure, which are considered as phytotoxic substrates for some plants, where similar cases were shown by Giller et al. (2006) and Zeng et al. (2008). However, seedlings in KH manures had longer roots than the other used manure types; a plausible reason to this response may be due to the fact that, the manure of KH had low nutrient content and in addition its high lignin might have caused further nutrients immobilization, especially N and P, from the media. In such conditions, roots have to explore more soil volume in search of nutrients to satisfy the growth needs of the seedlings, and this observation is in agreement with literature reports by Harris (1992) and Sileshi et al. (2007).

Generally, the results from this study, have shown the great potential of tree manures which can be incorporated in the nursery growing media. *Azadirachta indica* tree manures applications induced the highest effects on *Acacia senegal* seedlings followed by *Albizia lebbeck*. *Khaya senegalensis* manure was found to be less effective in stimulating *Acacia senegal* seedlings shoot height growth, but it induced root growth. Tree manures effects on *Acacia senegal* seedlings growth increased with increasing amounts of applications: 75 g > 50 g > 25 g doses.

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