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EFFECT OF LEAFLITTERS OF NITROGEN FIXING ACACIA TREES ON THE GROWTH OF AFRICAN STAR APPLE (*Chrysophyllum albidum* G.DON): A STEP TOWARDS ENHANCING THE GROWTH OF AN ENDANGERED SPECIES

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ABSTRACT
To meet the population demand for enormous benefits of an endangered species, Chrysophyllum albidum, its' slow growth need to be improved through the use of environmentally friendly leaf litters of nitrogen fixing acacia trees. Investigation conducted into effect of leaf litters of nitrogen fixing acacia trees (Acacia tortilis, Acacia seyal, Acacia nilotica, Acacia senegal, Acacia leucophloea and Acacia albida) at the rates of 300 g on the growth of C. albidum was laid down using a Completely Randomized Design with five replications. Results showed that leaf liters of nitrogen fixing acacia tree species significantly (P<0.05) enhanced the growth of C. albidum seedlings. Tallest plant (25 cm), widest leaf area (55.71 cm^2) and highest number of leaves (11), significant total fresh weight (48.45 g) and total dry weight (21.55 g) of C. albidum were recorded from seedlings planted in soil amended with A. senegal. Widest girth (1.92 cm) was recorded from seedlings planted in the soil influenced with A. leucophloea. Highest percentage values of 2.22 %, 0.90 % and 1.74 % were recorded for nitrogen, phosphorus and potassium content of A. senegal. Soil influenced with A. senegal enhanced the growth of C. albidum seedlings. Planting of C. albidum seedlings in the soil amended with A. senegal is recommended for mass production of its seedlings for agro-forestry systems as well as to increase biodiversity conservation.

Key words: Leaf litters, Nitrogen fixing tree species, Growth, Population demand, Agro-forestry

INTRODUCTION
Nigeria is one of the most densely populated countries in Africa, with approximately 200 million people in an area of 920,000km^2 (360,000sq mi), (Akinyemi and Isiugo-Abanihe, 2014; WHO, 2020) and is also the country with the largest population in Africa (Farrell, 2018; Akanonu, 2019; WHO, 2020) and the seventh largest population in the world (Favre, 2019). The current population of Nigeria is 205,192,124 based on Worldometer elaboration of the latest United Nations data. One of the major worries and concerns of ever dick and harry is how to eradicate poverty and improve food security (Oyebamiji *et al.*, 2019). Mbwambo *et al.* (2006) stated that agro-forestry is one of the answers that play an important role in increasing food security; improving nutrition and alleviating poverty. However, success of any agro-forestry system relies heavily on the choice of suitable tree species that should offer diversity of benefits and show compatibility with food crops (Edward *et al.*, 2006) and woody perennials. African star apple, *Chrysophyllum albidum* is one of such tree species.

Chrysophyllum albidum is also one of priority and multipurpose tree species of immense benefits in agro-forestry system in Africa. African star apple or White star apple is a climax tree species of tropical rainforest that belongs to the family of Sapotaceae (Wole, 2013; Olaoluwa *et al.*, 2012) which has up to 800 species (Ehiagbonare *et al.*, 2008). The Yoruba name of *C. albidum* is "Osan Agbalumo" (Rahaman, 2012) while in Igbo and Hausa languages, it is called "Udara" or "Udala" and "Agbaluba" or "Agbaluma" respectively (Wole, 2013, Adelani *et al.*, 2016). *C. albidum* has been noted to be of great economical (Onyekwelu *et al.*, 2011); nutritional and medicinal (Onyekwelu and Stimm, 2011) and industrial (Olaoluwa *et al.*, 2012) values. Ecologically, the tree has an efficient nutrient cycling and the high rate of mineralization of the leaves that improves the quality of the top soil (Aduradola *et al.*, 2005).

The World Agroforestry Centre (ICRAF) has identified *C. albidum* as one of the top five priority species for domestication in the African humid tropics (Tchounjeu *et al.*, 2002). Extensive human activities deplete the population of unregenerated *C. albidum* (Onyekwelu *et al.*, 2011) during irreversible conversion of forest areas to other uses. Despite the importance of *C. albidum*, it has been greatly neglected particularly with respect to their regeneration (Adelani *et al.*, 2014a, Adelani *et al.*, 2016). This calls for deliberate action to save the genetic erosion of this important species. Adelani and Okechalu (2016) stated that *C. albidum* has challenges of slow growth of seedlings and poor germination of seeds. There is need for the use of leaf litters of nitrogen fixing acacia to supply nutrients to enhance its growth for integration with arable crops in agro-forestry systems.

Agroforestry employs the use of fertilizer trees in improving the fertility of soils. Sarvade *et al.* (2014) mentioned that agro-forestry has a great potential of both restoring and maintaining soil fertility and increasing agricultural production. Researchers and planners are recommending agro-forestry systems for increasing agricultural production with improving soil nutrient status (Sarvade *et al.*, 2014). Biomass transfer is an agro-forestry practices that involve cut and carry of litters of agro-forestry tree species from one mother tree to place of restoring soil fertility. Schroth and Sinclair (2003) reported that biomass transfer systems represent an intermediate situation in which the nutrients in the biomass are added to the site where the biomass is applied, but are removed from another site within the same landscape.

The leaf litters of nitrogen fixing trees and other agro-forestry tree species are used in biomass transfer method. WAC (2018) stated that nitrogen fixing tree species have the ability to fix atmospheric nitrogen through symbiosis with bacteria or fungi in root nodules. ICRAF (2009) stated that nitrogen fixing trees enhance soil fertility and improve crop yields through their litters and nitrogen fixing process. The range of N_2-fixation capacity varies greatly amongst these trees (Giller, 2001). Nygren *et al.* (2012) pointed that annually, N_2-fixation may add from tens to hundreds of kilograms of N per hectare to an agro-forestry system. The most popular N_2-fixing trees used in tropical agro-forestry systems include the legumes *Acacia* spp., *Erythrina spp., Gliricidia* spp., *Inga* spp., and *Leucaena* spp., which form symbiotic associations with a wide variety of N_2-fixing bacterial species (Bala *et al.*, 2003).

Palm (1995) noted that nitrogen-fixing trees normally have higher nitrogen concentrations in the biomass than non-fixing species, but this characteristic also varies widely between species. There is dearth of quantified information on the effect of leaf litters of nitrogen fixing trees on the growth of woody perennials. In this light, this investigation was performed to assess the effect of leaf litters of nitrogen fixing acacia trees on the growth of *C. albidum* seedlings.

MATERIALS AND METHODS

Experimental Site

The pot experiment of this study was conducted during the wet season (2018) in the screen house of Federal College of Forestry Mechanization, Afaka, Kaduna State, Nigeria. The College is located in the Northern Guinea Savannah ecological zones of Nigeria. It is situated in Chikun Local Government Area of Kaduna State, Nigeria. It lies between Latitude 10^o 35′ and 10^o 34′ and Longitude 7^o 21′ and 7^o 20′ (Adelani, 2015). The mean annual rainfall is approximately 1000 mm. The vegetation is open woodland with tall broad leave trees (Otegbeye *et al.*, 2001).

Collection and Preparation of Experimental Materials

The biomass transfer method which involves the collections of wet leaves was used because some of nitrogen fixing acacia tree species was not located in the same site. The leaves of nitrogen fixing acacia tree species were air dried and pulverized. The sand was collected from the floor of the College dam, passed through 2 mm sieve and soaked in 10 % hydrochloric acid for 24 hours to remove impurities, organic matter and nutrient residue (Adelani *et al.*, 2014a). The poly pots of 20 x 10 x 10 cm^3 capacity filled with sterilized river sand in the nursery was used.

Chemical Analysis of Leaf Litters of Nitrogen Fixing Acacia Trees

Each sample of pulverized leaves of nitrogen fixing tree species after air dried was analyzed chemically for nitrogen, phosphorus and potassium (NPK) content at the Federal University of Agriculture Abeokuta, Ogun State, Nigeria laboratory. Determination of total nitrogen was done by Macro Kjeldahi method. Available phosphorus (P) was extracted by Bray-1 method and determined colourimetrically. Extracts from the digestion of the leaves of the agro-forestry tree species were used to determine potassium by flame photometry.

Experimental Design

The experiment was laid down in a Completely Randomized Design with five replicates. The total sum of 35 seedlings was involved in the experiment. Six treatments and control was used for the study. Leaves of six nitrogen fixing acacia trees (*Acacia tortilis, Acacia seyal, Acacia nilotica, Acacia senegal, Acacia leucophloea and Acacia albida*) at the rates of 300 g each was mixed with the sterilized river sand and later packed into polythene pot of dimension of 20 x 10 x 10 cm^3. Seedlings planted in the sterilized river sand without amended with leaf litters of nitrogen fixing trees served as control. Volume of 120 mL of water was applied daily to the seedlings in the polypots. Seedling assessment was carried out after first two weeks of transplanting to ensure that seedlings were established before the commencement of assessment. Seedling assessment was taken every two weeks for 16 weeks. The mean of every four weeks was tabulated. Parameters assessed include: seedling height (using meter rule), number of leaves and collar girth (using venier calliper). Leaves were counted manually while leaf area was obtained by linear measurement of leaf length and leaf width as described by Ugese *et al.* (2008) as stated in the formula below.

$$LA=4.41+1.14LW \quad [1]$$

Where:

LA= leaf area

LW= Production of linear dimension of the length and width at the broadest part of the leaf

Data Analysis

Data were collected and subjected to analysis of variance (ANOVA) using SAS (2003) software to compare significant means. Significant means at 0.05 was separated using Fishers Least Significant Difference (LSD).

RESULTS

Tallest plant of 25 cm was recorded from seedlings planted in soil amended with *A. senegal* at 16 WAT. Significant value of 25cm was recorded from seedlings planted in the soil amended with the leaf litters of *A. senegal* as compared to the least value of 3.67cm obtained from seedlings planted in soil not mixed with leaf litters of nitrogen fixing acacia trees (Table 1).

Table 1: Effect of Leaf Litters of Nitrogen Fixing Acacia Trees on Height (cm) of *C. albidum* Seedlings

N FAT	Weeks After Transplanting			
	4	**8**	**12**	**16**
A. seyal	16.67^{b}	17.67^{b}	17.67^{b}	21.37^{a}
A.nilotica	17.33^{b}	17.67^{b}	21.00^{ab}	22.67^{a}
A.tortilis	16.67^{b}	17.33^{ab}	19.33^{ab}	20.43^{a}
A. senegal	17.67^{b}	18.67^{b}	23.67^{ab}	25.00^{a}
A.leucophloea	15.00^{c}	16.67^{ab}	18.67^{b}	21.43^{a}
A.albida	16.33^{b}	17.33^{b}	17.67^{b}	22.03^{a}
Control	3.67^{c}	3.67^{c}	4.67^{b}	5.67^{a}
SE±	**0.29**	**0.30**	**0.34**	**0.38**

**Means on the same rows having different superscript are significantly different (P<0.05*

Key: NFAT- Nitrogen Fixing Acacia Trees

Effect of Leaf Litters of Nitrogen Fixing Acacia Trees on the Girth of *C .albidum S*eedlings

The widest girth of 1.92 cm was recorded for seedlings planted in the soil amended with *A. leucophloea* at 8 WAT. The narrowest girth of 0.14 cm was recorded from seedlings planted in the soil not mixed with leaf litters of nitrogen fixing acacia trees. The girth (1.92) of seedlings planted in the soil mixed with *A. leucophloea* at 8 WAT was significantly (P<0.05) different from that of control (0.14cm) (Table 2).

Table 2: Effect of Leaf Litters of Nitrogen Fixing Acacia Trees on the Girth (cm) of *C .albidum S*eedlings

NFTS	Weeks After Transplanting			
	4	**8**	**12**	**16**
A.seyal	1.46[a]	1.68[a]	0.26[a]	0.21[a]
A.nilotica	1.60[a]	1.48[a]	0.27[a]	0.22[a]
A.tortilis	1.36[a]	1.70[a]	0.46[a]	0.41[a]
A.senegal	1.37[a]	1.65[a]	0.31[a]	0.26[a]
A.leucophloea	1.29[a]	1.92[a]	0.43[a]	0.38[a]
A.albida	1.54[a]	1.48[a]	0.52[a]	0.47[a]
Control	1.00[a]	1.00[a]	0.14[b]	0.14[b]
SE±	**0.25**	**0.28**	**0.06**	**0.06**

**Means on the same rows having different superscript are significantly different (P<0.05).*

Key: NFAT- Nitrogen Fixing Acacia Trees

Effect of Leaf Litters of Nitrogen Fixing Acacia Trees on the Number of Leaves of *C. albidum* Seedlings

Highest number of leaves (11) was recorded from seedlings planted in the soil amended with *A. senegal* at 16 WAT. The number of leaves recorded for seedlings planted in soil amended with *A. senegal* (11) at 16 WAT was significantly (P<0.05) different from that of least value (3.67) recorded for untreated seedlings at 4 WAT (Table 3).

Table 3: Effect of Leaf Litters of Nitrogen Fixing Acacia Trees on the Number of Leaves of *C. albidum* Seedlings

NFAT	Weeks After Transplanting			
	4	**8**	**12**	**16**
A. seyal	7.67[b]	8.00[b]	8.67[ab]	9.67[a]
A. nilotica	8.00[b]	8.00[b]	9.33[ab]	10.00[a]
A.tortilis	8.00[b]	8.33[b]	8.33[b]	10.33[a]
A.senegal	7.33[c]	8.33[bc]	9.00[b]	11.00[a]
A.leucophloea	7.33[b]	8.00[b]	8.67[b]	10.67[a]
A.albida	7.67[b]	8.00[b]	8.67[b]	10.67[a]
Control	3.67[b]	4.00[b]	5.00[a]	5.33[a]
SE±	**0.14**	**0.14**	**0.16**	**0.18**

**Means on the same rows having different superscript are significantly different P (<0.05)*

Key: NFAT- Nitrogen Fixing Acacia Trees

Effect of Leaf Litters of Nitrogen Fixing Acacia Trees on the Leaf Area of *C. albidum* Seedlings

The widest and significant leaf area of 55.71cm^2 was recorded from seedlings planted in the soil influenced with *A. senegal* at 4 WAT. The least value of 10.32cm^2 was recorded for leaf area of seedlings planted in unamended soil (control).

Table 4: Effect of Leaf Litters of Nitrogen Fixing Acacia Trees on the Leaf Area (cm^2) of *C. albidum* Seedlings

NFTS	Weeks After Transplanting			
	4	8	12	16
A. seyal	52.98[a]	29.22[b]	26.54[b]	31.54[b]
A.nilotica	44.32[a]	21.95[b]	13.74[b]	18.74[b]
A.tortilis	47.53[a]	26.95[b]	13.49[b]	18.49[b]
A.senegal	55.71[a]	28.61[b]	16.80[b]	21.80[b]
A.leucophloea	22.40[a]	27.60[a]	16.35[a]	21.35[a]
A.albida	34.45[a]	29.04[a]	13.27[b]	18.27[ab]
Control	10.32[b]	15.61[a]	10.34[b]	15.34[a]
SE±	**2.51**	**1.60**	**0.98**	**1.27**

**Means on the same rows having different superscript are significantly different P (<0.05)*

Key: NFTS- Nitrogen Fixing Tree Species

Effect of Leaf Litters of Nitrogen Fixing Acacia Trees on the Leaf Area Index of *C. albidum* Seedlings

Significant leaf area index (1.92) was recorded from seedlings planted in the soil amended with *A. senegal* at 4 WAT compared to least value (0.12) recorded in soil not mixed with leaf litters of nitrogen fixing acacia trees at 16 WAT (Table 5).

Table 5: Effect of Leaf Litters of Nitrogen Fixing Acacia Trees on the Leaf Area Index of *C. albidum* Seedlings

NFAT	Weeks After Transplanting			
	4	8	12	16
A.seyal	1.46[a]	1.68[a]	0.26[b]	0.21[b]
A.nilotica	1.37[a]	1.65[a]	0.31[b]	0.26[b]
A.tortilis	1.36[a]	1.70[a]	0.46[b]	0.41[b]
A.senegal	1.92[a]	1.29[a]	0.43[b]	0.38[b]
A.leucophloea	1.60[a]	1.48[a]	0.27[b]	0.22[b]
A.albida	1.54[a]	1.48[a]	0.52[b]	0.47[b]
Control	1.00[a]	1.00[a]	0.12[a]	0.12[a]
SE±	**0.14**	**0.14**	**0.03**	**0.03**

**Means on the same rows having different superscript are significantly different (P<0.05).*

Key: NFAT- Nitrogen Fixing Acacia Trees

Effect of Leaf Litters of Nitrogen Fixing Acacia Trees on the Fresh and Dry Weight of *C. albidum*

A significant total fresh weight of 48.45 g was recorded from seedlings planted in soil amended with *A. senegal*. A significant total dry weight of 21.55 g was recorded from seedling planted in soil mixed with *A. senegal.* Significant fresh leaf weight (19.05 g) and dry leaf weight (8.30 g) were recorded in seedlings planted in the soil influenced with *A. senegal*. The least values of 3.70 g and 0.45 g were recorded for total fresh weight and total dry weight of seedlings planted in the soil not amended with leaf of nitrogen fixing acacia trees (Table 6).

Table 6: Effect of Leaf Litters of Nitrogen Fixing Acacia Trees on the Fresh and Dry Weight (g) of *C. albidum*

N FAT	FW			TFW	DW			TDW
	L	S	R		L	S	R	
A.seyal	2.60^a	1.35^a	2.25^a	6.20^e	1.10^a	0.65^a	0.75^a	2.50^f
A.nilotica	7.50^a	6.35^a	5.10^a	18.95^d	3.35^a	3.45^a	2.00^b	8.80^d
A.tortilis	9.95^a	6.20^a	7.45^a	23.60^c	4.45^a	3.50^b	3.10^b	11.05^c
A.senegal	19.05^a	12.30^b	17.10^a	48.45^a	8.30^a	6.45^b	6.40^b	21.15^a
A.leucophloea	11.40^a	7.85^a	8.55^a	27.80^b	4.75^a	4.15^a	3.65^b	12.55^b
A.albida	7.05^a	3.80^a	6.70^a	17.55^d	3.15^a	2.05^b	1.95^b	7.15^e
Control	1.40^a	1.00^a	1.30^a	3.70^e	0.18^a	0.10^a	0.17^a	0.45^f
SE±	**0.67**	**0.44**	**0.55**	**1.66**	**0.29**	**0.23**	**0.21**	**0.73**

**Means on the same rows having different superscript are significantly different (P <0.05) for Fresh weight and dry weight.*
** Means on the same columns having different superscript are significantly different (P<0.05) for Total fresh weight and Total dry weight.*

Key: NFAT- Nitrogen Fixing Acacia Trees WAT- Weeks After Transplanting, FW –Fresh Weight, TFW –Total Fresh Weight, DW-Dry Weight -, TDW –Total Dry Weight, L-Leaf, S-Shoot, R –Root.

Percentage Nutrient Composition of Leaf Litters of Nitrogen Fixing Acacia Trees

Highest percentage values of 2.22 %, 0.90 % and 1.74 % were recorded for nitrogen, phosphorus and potassium content of *A. senegal* .The least values of 0.04%, 0.23 % and 0.15% were recorded for seedlings planted in soil not influenced with leaf litters of nitrogen fixing acacia trees (Table 7).

Table 7: Percentage Nutrient Composition of Leaf Litters of Nitrogen Fixing Acacia Trees

NFAT	Nitrogen (%)	Phosphorus (%)	Potassium (%)
A. seyal	1.89	0.79	1.67
A. nilotica	2.08	0.81	1.73
A. tortilis	1.91	0.80	1.71
A. senegal	2.22	0.90	1.74
A. leucophloea	2.16	0.79	1.72
A. albida	1.98	0.84	1.70
Control	**0.04**	**0.23**	**0.15**

Key: NFAT - NFAT- Nitrogen Fixing Acacia Trees

DISCUSSION

Tallest plant was recorded from seedlings planted in soil amended with *A. senegal*. Similar observation has been reported by Adelani (2019) who recorded highest number of growth parameters for *Citrus tangelo* planted in the soil amended with *Pentaclethra microphylla*. It can be inferred that *A. senegal* contained and released higher number of nitrogen for plant growth compared to other nitrogen fixing tree species investigated. This result is in consonance with the reports of Ahmed *et al.* (2006) and Silvia and Victor (2008). The widest leaf area was recorded from seedlings planted in the soil influenced with *A. senegal*. This result is in line with the reports of Odeyemi *et al*. (2015) and Adelani (2019).

Highest leaf area index was recorded in seedlings planted in the soil amended with *A. senegal*. It can be deduced that *A. senegal* was able to supply nutrients for highest leaf area to cover land area. Similar observation has been reported by Adelani *et al.* (2017a) and Adelani (2019). Highest percentage of nitrogen, phosphorus and potassium were recorded for *A. senegal*. Similar observation has been reported by Adelani *et al.* (2014b) and Adelani *et al*. (2017a).

The excellent performance of *A. senegal* in term of enhancing growth parameters is adduced to functions of its component nitrogen. Nitrogen is most critical element require for plant growth. Nitrogen is the mineral element that plant requires in larger amounts and is a constituent of many plant cell components, including amino and nucleic acid (Nathan, 2009, Hu and Schmid halter, 2005). It has ability to improve water absorption and protein synthesis and equally promotes cell division as well as elongation of seeds and seedlings. Similar observation has been reported by Adelani *et al* (2017a).

Nitrogen is part of various enzymatic proteins that catalyses and regulates plant-growth process (Sinfield *et al.,* 2010). It is a component of chlorophyll (Anderson, 2015). Nitrogen has been called the growth element because it is a vital part of protoplasm. Protoplasm is the seat of cell division (Abod and Siddiqui, 2002). Improved growth recorded for seedlings planted in the soil amended with *A. senegal* is traceable to its ability to utilize and mobilize metabolites better to growing points.

It can be concluded from this investigation that *A. senegal* was the best source of nitrogen. Various investigations such as Camberato (2001) (Turfgrass)., Ohlund and Nasholm (2001) (*Picea abies*)., Warrren and Adams (2002) (*Pinus pinaster*) and Khamis *et al*.(2013) (*Populus euphratica*) have reported the efficacy of sources of nitrogen in enhancing the growth of plant.

Phosphorus content of *A. senegal* enhanced the growth of *C. albidum* seedlings. Similar observation has been reported by Adelani *et al.* (2017b). Phosphorus is an important component of *Gliricidia sepium* (Adelani *et al.*, 2014b) which help in the germination of seeds (Mengel and Kirkby 2001; Smith, 2014) and seedling growth (Adelani *et al.*, 2014a). Phosphorus is considered a primary nutrient for plant growth (Hinsinger, 2001) and is needed to sustain optimum plant production and quality (Zepata and Zaharah, 2002). The element is essential for cell division, reproduction, and plant metabolism; moreover, its role is related to the acquisition, storage, and use of energy (Epstein and Bloom, 2004).

In addition, phosphorus plays an important role in lateral root morphology (Williamson *et al.,* 2001) and root branching (Lopez-Bucio *et al.,* 2003) and influences not only root development, but also the availability of nutrients (Jin *et al.*, 2005). Therefore, plants have developed various strategies for obtaining optimum phosphorus from soils, including increases in root surface area, specific root length (SRL), and root-shoot ratio (Tang *et al.*, 2009; Xu *et al.,* 2012). The growth-promoting role of phosphorus application has been reported previously (Williamson *et al.*, 2001, Waraich *et al.*, 2005; Pandey *et al.*, 2006). This is in consonance with the reports of Hudai *et al.* (2007) and Cicek *et al.* (2010).

The present study also confirmed the results of Jin *et al*. (2005) who reported that phosphorus application increased total root length and average root diameter. In most species, phosphorus deficiency results in decreased average root diameter (Hill *et al.*, 2006) however, some species, such as *Arabidopsis thaliana*, developed larger roots in phosphorus deficient conditions (Ma *et al.*, 2001).

Based on the findings in this investigation, *A. senegal* reported highest potassium content which influenced the growth parameters of *C. albidum* seedlings. The essential characteristics of its potassium content accounted for highest growth parameters of *C. albidum* planted in it. Potassium is an essential element that functions in activation of enzymes., (Mengel, 2001; Marschner, 2012), the translocation of photosynthates and the synthesis of cellulose, a building block of every plant cell wall (Anghinoni and Bissani, 2004; Havlin *et al.*, 2005; Sardans and Penuelas, 2005; Wang *et al.*, 2013), transplant of sugars from leaves to fruits, and production and accumulation of oils (Romheld and Kirky, 2010). Some studies have shown that potassium fertilization resulted in a marked improvement in water use efficiency (Ashraf *et al.*, 2001).

Adequate potassium supply is essential to enhancing drought resistance by increasing root elongation and maintaining all membrane stability (Datnoff et *al.*, 2007; Wang *et al.*, 2013). An efficient potassium status may facilitate osmotic adjustment which maintains higher turgor pressure, relative water content and lower osmotic potential, thus improving the ability of plants to tolerate drought stress (Kant and Kafkafi,2002; Egilla *et* *al.*, 2005). Potassium plays a crucial role in turgor regulation within the guard cell during stomatal movement (Wang *et al.*, 2013). This element improves winter hardiness, the rigidity of young stems and increases diseases resistance. The least growth parameters recorded in seedlings planted in soil not influenced with leaf litters of nitrogen fixing acacia trees could be traced to lack sufficient nutrients as nitrogen, phosphorus and potassium. This result is in consonance with the reports of Adelani *et al.* (2014b).

CONCLUSION

The use of leaf litters of nitrogen fixing acacia trees to enhance the soil fertility for the fast growth of *C. albidum* is a viable option. Investigation conducted into the effect of sources of leaf litters of nitrogen fixing acacia trees on the growth of *C. albidum* revealed that the highest growth parameters were recorded in seedlings planted in the soil amended with *A. senegal*. The use of leaf litters of *A. senegal* is recommended for fertilizing *C. albidum* seedlings in order to increase biodiversity conservation of this indigenous and endangered species.

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