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COMPARATIVE STUDY of *Parkia biglobosa* (Jacq) R. Br.ex G. Don and *Azardirachta indica* A. Juss ROOT SYSTEM OF THE PLANTING STOCKS THROUGH POTTING AND SEEDBED

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Abstract
The study was conducted to compare the growth response of Parkia biglobosa and Azardirachta indica root system of the planting stocks through potting and seed bed. Seeds were sown in polythene pots of length (18cm) and diameter (14cm); filled with a mixture of top soil and sand at the ratio of 2:1 for pot experiment while seed bed at spacing of 1 x 1m on a plot size of 3 x 3m applied. Nine seeds were sown for each treatment for comparing between the seed beds of both species and potting study for the both species. Thirty six seeds were sown and early growth responses were monitored for twelve weeks. Morphological attributes such as root length and shoot height were measured with the aid of ruler. Data collected from the study was compared with the use to the independent T-test and descriptive statistic such as bar chart. The results revealed that pot experiment had the best performance for shoot height while seedbeds were efficient for the root development for both species. Therefore, seedbed is recommended for tree in savannah and dry season planting while the use of pot is better for the yield.

Key Words: *Parkia biglobosa, Azardirachta indica, Root system, Planting stocks, Potting stage, Seed bed*

Introduction
The development of tree roots found below-ground (hidden) parts of plants, depends to a large extent on site conditions as the roots continuously adapt to the temporal and spatial fluctuations of their growth medium (Alexia *et al.,* 2009). Site conditions dictate such things like the availability of water, aeration, organic matter content and other minerals within the soil, required for the physiological and morphological growth of plants (Schenk and Jackson, 2002). The interactions between trees, soil nutrients and their subsequent absorption and transportation takes place through the roots. In a water-limited environment, in addition to site conditions, the availability of these resources also depends on the sizes, shapes of the root systems and root competition (Schenk and Jackson, 2002). Root architecture is significance in evaluating the overall anchorage capacity of a tree (Dupuy *et al.*, 2007). Generally, roots play

an important role in determining the size of a tree. Little scientific study has been done, however on the problems of the degraded natural forest, particularly those relating to their reforestation with fast growing native and exotic tree species. This aspect needs to be considered particularly urgently because of the continuing destruction of the areas of primeval forest that still remain as well as massive reforestation of the drought stricken area (Arnborg, 1985). For a thorough ecological knowledge of the temporal variations of roots dynamics expressed in quantitative unit, the rather scanty root study data are indispensable. Wareing, (1969) made a similar contribution when he said that a tree, which has poor root system, is likely to be at disadvantageous in the exploitation of the soil for water and mineral nutrients. Most common garden experiments of biomass partitioning by species growing across resource gradients have concentrated on nutrients and light, whereas water has rarely been tested (Kyle *et al.,* 2012). Defoliation pressure is one selective force that may affect biomass allocation to organs (Kyle *et al.,* 2012). Importantly, this prediction is opposite to the expectation based on resource capture theories (Eric, 1993) that partitioning to roots is greater among species from semi-arid environments than species from humid. Under water-stressed conditions may optimize their foraging strategies for water resources in the soil through root morphology instead of root mass partitioning. Drier environments are also characterized by greater rainfall variability and more frequent drought events during the growing season than wetter environments (Ward, 2009). Fire is a non-selective defoliator that removes shoot biomass. Tree juveniles and seedlings rarely have sufficiently large stems to resist fire events and die back at or near ground level (Bond *et al.,* 2005). Many savanna species overcome this 'fire trap' (Higgins, *et al* 2000) by accumulating growth reserves underground, beyond the reach of fires, from which they can develop new shoots after fire events (Wigley *et al*., 2009).

Neem tree needs little water and plenty of sunlight. The tree grows naturally in areas where the rainfall is in the range of 450 to 1200 mm. However, it has been introduced successfully even in areas where the rainfall is as low as 200 – 250 mm (Jibo *et al.*, 2018). It cannot withstand water-logged areas and poorly drained soils (neem foundation). It is a typical tropical to subtropical trees at annual mean temperatures of 21-32ºC the trees are not at all dedicate about water quality and thrive on the nearest tickle of water and whatever the quality (Salami and lawal, 2018a). It grows best in dry regions with annual rainfall of about 650mm pa but will survive down to 400mm and up to 1200mm in some circumstances. In its native areas it is found up to 1500m above sea level. The ideal temperature range is 21-36°C but it can survive up to 45°C. It is not adapted to high rainfall, humidity or frost, and usually occurs in isolated stands either domestically or in parks, or wild across the African savannahs (Wilkinson, 2005).

The seeds of *Azadirachta indica* cannot grow effectively in river sand because of the low growth vigour in the stem diameter, shoot height and leaf production of seedlings compared to potting mixture river sand, top soil and poultry manure in which the seedling sown (Jibo *et al.*, 2018). Fertilizer is very important for plant growth and productivity. Farms and nurseries use various seedling and potting media in the production of field transplants, container plants, and greenhouse crops. Neem can grow in many different types of soil but it thrives best on well drained deep and sandy soils. Neem can grow in many different types of soil but it thrives best on well drained deep and sandy soils (Salami and Lawal, 2018a). Use of suitable growing medium or substrate is essential for the production of quality crop or tree (Jibo *et al.*, 2018).

There is need for further research into this particular field of root biology in the next germination of ecosystem studies, particularly with reference to the tree species in the Sahel zone of Nigeria, being worst prone to diverse climate variations, much as it is grossly short of essential moisture fundamental for effective plant growth.

The establishment of tree roots depends to a large extent on site conditions as roots adapt to the temporal and spatial fluctuations of their growth medium. Information of the maximum rooting depth and lateral root spreads are important as they could be useful for predicating as such the functional differences between plant growth forms today and under future climate change scenarios. Therefore, this study tends to examine the root and shoot growth patterns of two different tree species at the seedling stage and under two different methods of propagation with the view of choosing and recommending the best planting method for the consumers and growers.

The specific objectives are to:

i. determine the best rooting and shooting *attributes of Parkia biglobosa*
ii. determine the best rooting and shooting *attributes of Azardirachta indica* through pottings and seedbeds

Plate 1: *Azardirachta indica* tree
Source: prgcbotany.blogspot.com

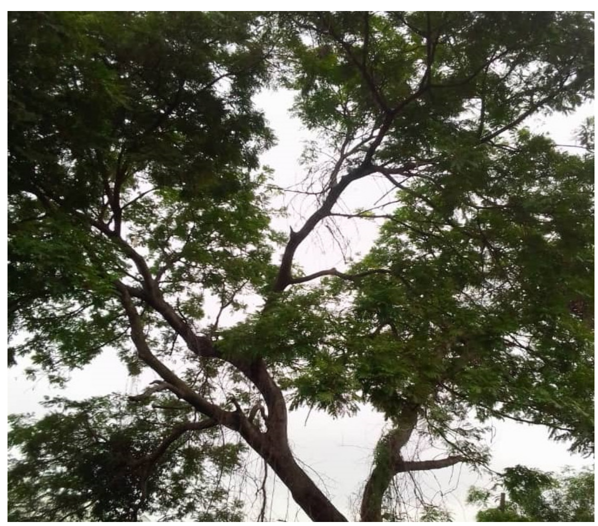

Plate 2: *Pakia biglobosa* tree

Material and Methods

Study Area

The experiment was carried out in the Department of Forestry, Federal University Dutse Jigawa State. Study area lays between latitudes 11.00ºN to 13.00ºN and longitudes of 8.00ºE to 10.15ºEwith a mean temperature of 29° C, mean rainfall of 3000 mm and a mean relative humidity of 75% (Jibo *et al,* 2018; Salami *et al.,* 2019). The state was created in 1991 during the military regime of General Ibrahim Badamasi Babangida. Dutse (Dutsi in earlier notes) got its name from rocky topography peculiar to the area. Different forms of rocks can be seen widely spread across the town. Federal University Dutse was established in November 2011. The amount of rainfall receives annual is usually around 743mm. The average annual temperature is 34.5ºC. The topography is characterized by high land area which is almost 750meters. Soil tends to be fertile ranging from loam (Salami and Lawal, 2018b).

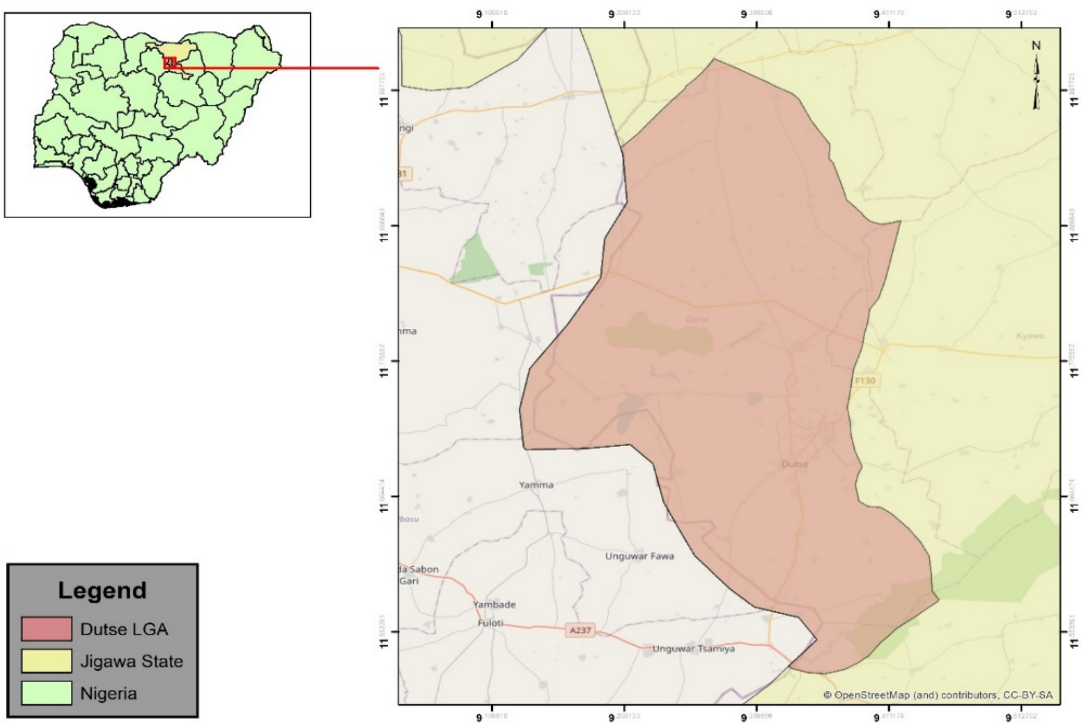

Fig. 1: Map of Dutse

Data Collection and Plant Materials

Ripe seeds *of Parkia biglobosa* and *Azardirachta indica* were collected from the mature mother trees. Topsoil and river sand were collected from the Departmental nursery which was mixed at the ratio of Top soil (1 portion), river sand (1 portion) (Jibo *et al*, 2018). The black polythene pots were purchased from the departmental nursery. Other material like spade, watering can and head pan were also collected from nursery attendant.

Pre-germination Treatment and Sampling Procedure

Two species were used for the experiment included: *Azardirachta indica* *and Parkia biglobosa*. Procedure used in the survey is in two (2) groups. Group 1: seeds were soaked in water at room temperature of 27ºC for 24hrs as a pre-treatment to overcome seed dormancy (Doran *et al.,* 1983). Seeds were sown in polythene pots 18cm high and 14cm in diameter, containing a 2:1 mixture of top soil and sand, have a 9 seedlings for each, grown, observed for twelve (12) weeks under standard watering in the nursery while the group (2) pre-treatment of the seeds were sown at spacing of 1 x 1m on a plot size of 3 x 3m with nine (9) seedlings each. Soil was removed using a sharp blade from the surface downward to search for the roots. At the end of the experiment, shoots were removed at the base and roots were thoroughly washed of soil particles. Total root length was determined by laying out the washed roots on a flat surface and measurement was taken with meter rule, before drying in to obtain dry weight. Shoot dry mass and root dry mass was determined. Root/shoot mass ratio and total plant biomass was calculated.

Data Analysis

Data collected from the study was compared with the use to the T-test and descriptive statistics. Graphical representative tool such as bar chart was applied.

Results

Germination Period

For the two studied species, germination took place in two to three weeks from the sowing date. Germination process was progressive since all seedlings did not germinate in the same week.

Germination Rate

Out of thirty seeds sown in seedbed method for *Azadirachta indica*, only twenty was germinated (66.67%). For thirty seeds sown directly in pots, only 26 germinated (86.67%). Seventeen, (56.67%) for *Parkia biglobosa* germinated from thirty seeds sown in seedbed method. Direct sowing in pots produced 22 (73.33%). This germinated from three hundred seed which were sown. For all the two methods, potting method germinated at high percentage in polythene pots.

Table 1: Illustration of germination rate for studied species

Tree species	**Sowing method**	**Total number of seed sown**	**Germinate seed sown**	**Percentage (%)**
Azadirachta indica	Seed bed	30	20	66.67
	Potting	30	26	86.67
Parkia biglobosa	Seed bed	30	17	56.67
	Potting	30	22	73.33

Finding from figure 1 showed that seeds sown in the pots had highest shoot height ranged from 2nd week to 12th week of planting. This showed that nursery planting through the use of the pot supports the early growth of neem. Shoot height had the highest mean value of (24cm) for pots, followed by seedbed with the value of (21.9cm) at the 12th week of planting.

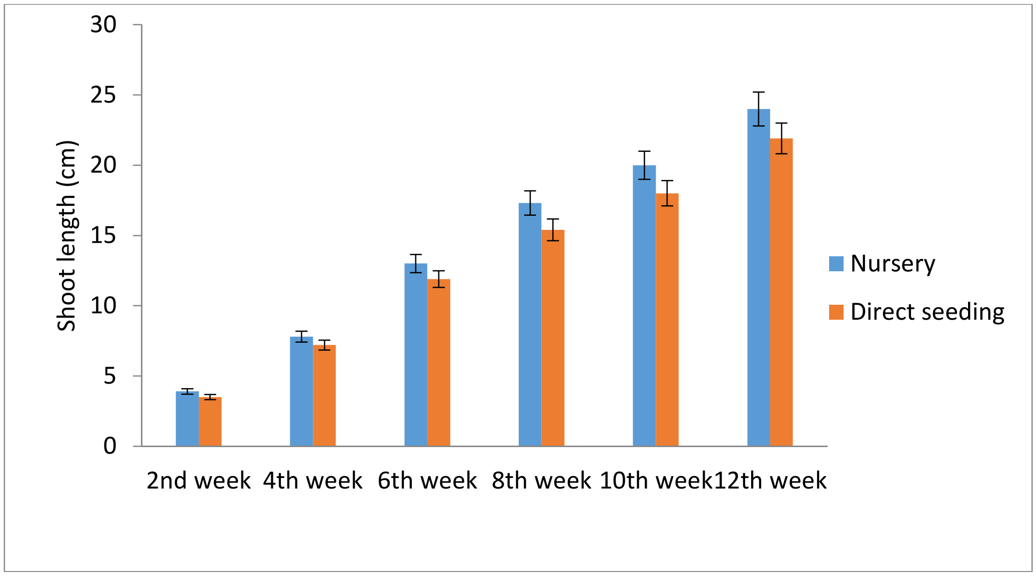

Fig. 1: showing the shoot length (cm) of the neem

Results from figure 2 showed that seeds sown in the seedbed had highest root length ranged from 2nd week to 12th week of planting. This showed that seedbeds support the root development of neem. Root length had the highest mean value of (21cm) for direct seeding, followed by seeds established by the pots with the value of (17.9cm) at the 12th week of planting.

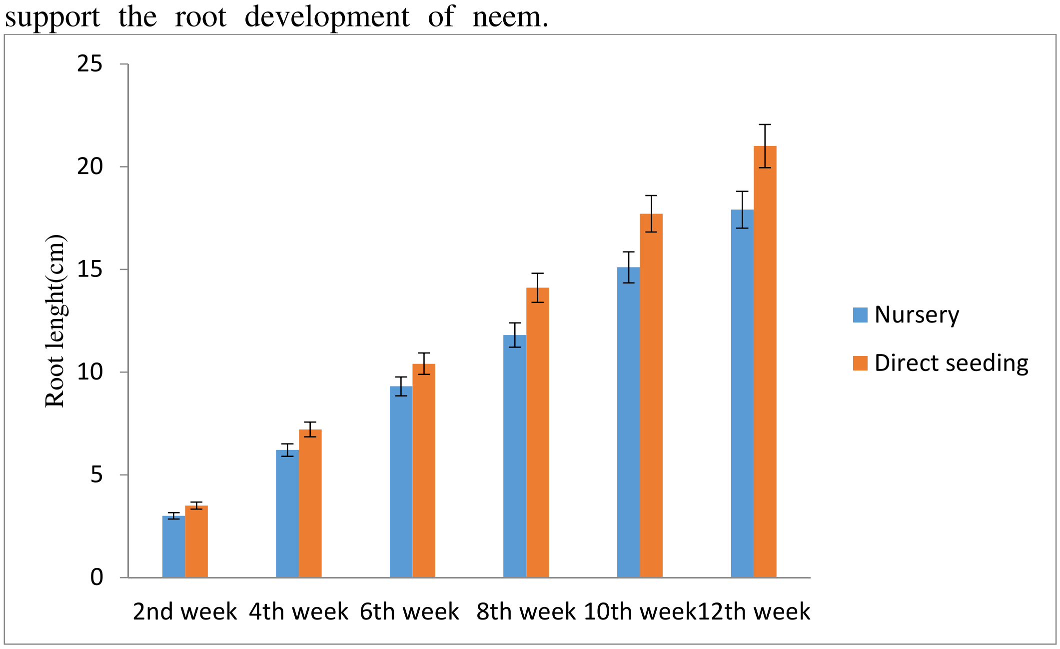

Fig. 2: Showing the mean root length (cm) of neem

Finding from figure 3 revealed that seeds sown in the pots had highest shoot height ranged from 2nd week to 12th week of planting. This showed that nursery planting through the use of pots support the early growth of *Parkia spp*. Shoot height had the highest mean value of (21.2cm) with the pots, followed by seed bed with the value of (20.8cm) at the 12th week of planting.

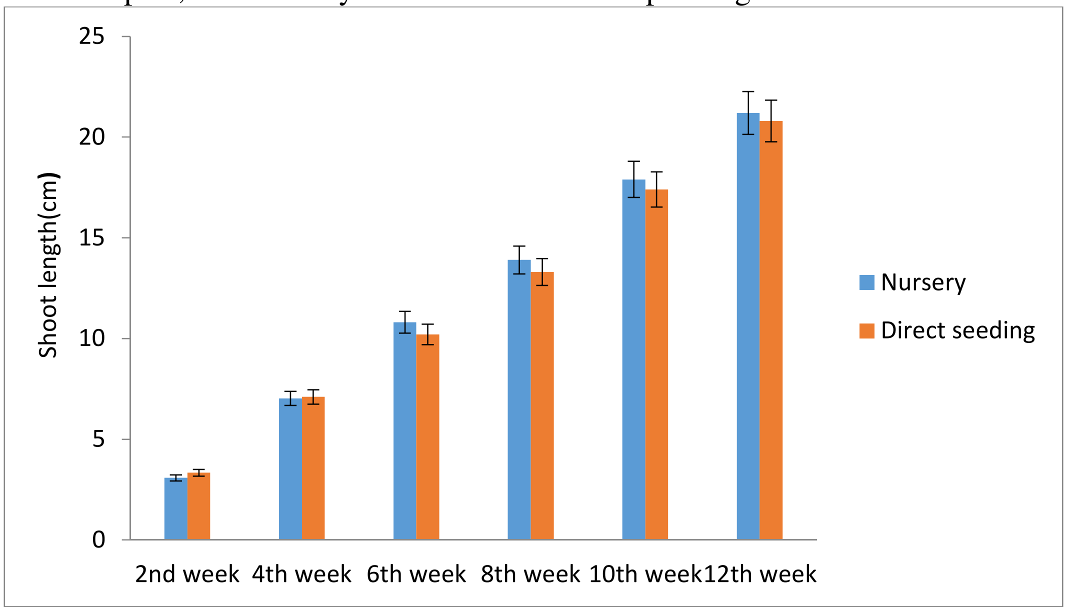

Fig. 3: Showing the mean shoot height of *Parkia* spp

Results from figure 4 showed that seeds sown in the seedbeed had highest root length ranged from 2nd week to 12th week of planting. This showed that nursery planting support the early growth of neem. Root length had the highest mean value of (14.2cm) for direct seeding through the use of seed bed, followed by seeds established at the nursery (pots) with the value of (12.8cm) at the 12th week of planting.

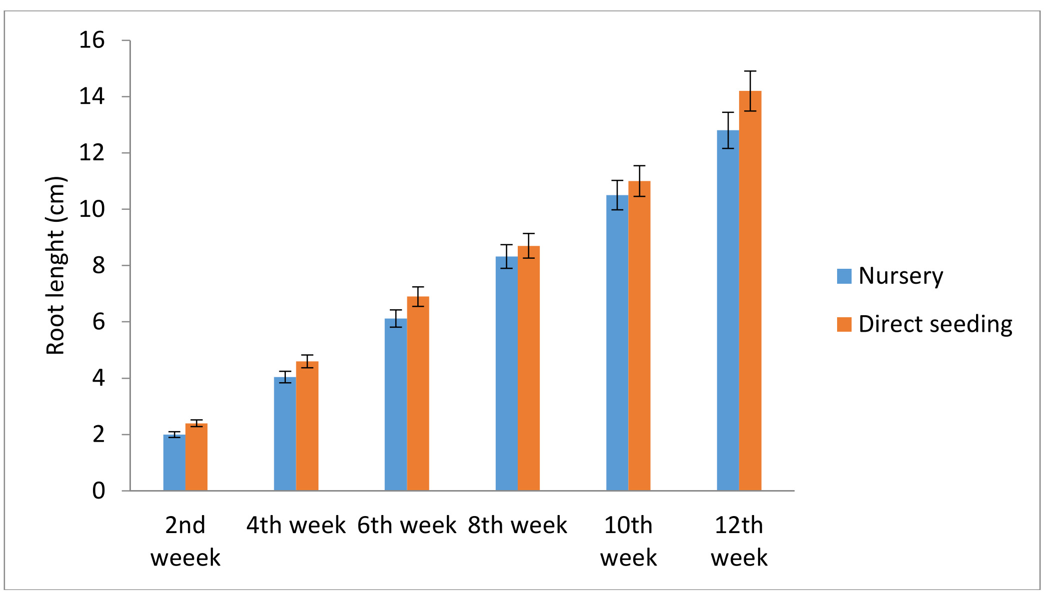

Fig. 4: showing the root length (cm) of *Parkia* spp

Discussion

The mean shoot height measured and collected from both tree species established through the use the pots and seedbed in the nursery. The study showed that potting method performed better than seedbeds while root length was the best for seedbeds of the both species. Seedlings in the pots showed a higher mean value at 12th week of the planting (24cm, 21.2cm) in shoot height for neem and parkia compared to seedlings in seedbeds. This implied that the soil nutrient in the pots has high and positive impact in the growth of the upper part of the seedlings. Furthermore, the rate of leaching was minimal since pot was used for the study. Invariably, seedbed supported the root length development for both species. Data collected showed that seedbeds had the highest mean root length (21cm, 14.2cm) for neem and parkia compared to seedling grew under nursery management (potting). Significant differences were observed between the potting and seedbeds at 5% probability level for the species. This study supports the observation of (Vincent, 2017) that seedlings in pots showed wide variability in shoot height among themselves and a large deviation from the true mean compared to seedlings in seedbed both in mean height and coral diameter. Yücedağ and Gailing, (2012) observed that seedbeds of size 1.2 m wide with 5 rows each 20 cm apart significantly affected root collar diameter, shoot height, tap root length and number of fine roots in *A. communis* and *P. avium*, but not in *P. elaeagnifolia* and *E. tribolatus*.

Conclusion

This research undertook in the nursery for studied the two savannah species namely: *Parkia biglobosa and Azardirachta indica* when seeds are sown directly in pots and directly in seedbed. The study showed that germination of the seeds and shoot development of the species in the nursery proved better than seedbeds while better root formation can be traced to direct seeding (seed bed).

Recommendations

Establishment of potting type for tree production like neem and parkia becomes inevitable since it's proving to be the best for the growth of the shoot growth. Furthermore, seedbed is recommended for savannah tree and dry season planting. Since heavy loads of the nutrients are embedded in the seedbed. The root will able to absorb the nutrient and adapt to the environment.

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