

Performance of Leafy Biomass of *Parkia biglobosa* and *Albizia lebbeck* with Urea on Maize Growth in Makera, Nigeria

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ABSTRACT

The technology of using biomass transfer is a major environmental friendly technology that provides better conditions for soil. The study assessed the performance of leafy biomass of *Parkia biglobosa* and *Albizia lebbeck* with urea on maize growth in Makera, Nigeria. The experiments were laid out as 3 x 4 x 2 factorial in a split-split plot design with three replicates for two years. These factors were: biomass species (*Albizia lebbeck* and *Parkia biglobosa*) and control as main plots, four levels of nitrogen (0, 40, 80, 120 kg N ha⁻¹) as sub-plots, and two maize varieties (DMR-ESR-7 and 2009 EVAT) as sub-sub plots. Data collected on leaves biomass and maize yield were analysed using descriptive and inferential statistics (ANOVA) at $\alpha = .05$. *Albizia lebbeck* biomass performed better with higher average contents of N (3.24 %) and C (18.64 %) and lower average C: N ratio (5.75) than *Parkia biglobosa*. *Albizia lebbeck* biomass had higher significant effect on growth parameters compared to *Parkia biglobosa*. Nitrogen applications enhanced similar effects on growth components of both maize varieties compared to control. In conclusion, *Albizia lebbeck* decomposed and mineralized faster for maize uptake, and nitrogen application at 120 kg N ha⁻¹ with 2009 EVAT is a better combination for maize growth.

Keywords: Leafy biomass, maize growth, performance, tree species, urea

INTRODUCTION

Agroforestry is a land management system that accommodates both production of food crops and forest products on the same piece of land. It aims at increasing production of food and fibres. It has been discovered that food crisis, declining forest resources and environmental imbalance are some of the problems that are wide spread in Nigeria and the world today (Oyebamiji *et al.*, 2014). The agricultural production system in Nigeria as well as other developing countries of the world has deteriorated due to decline in soil fertility which has resulted to lack of capacity to produce enough food for their teeming population (Oyebamiji *et al.*, 2014). Farming systems in Nigeria and all over the tropics are under threat due to declining soil fertility (Adjei-Nsiah, 2012).

It is increasingly evident that declining soil fertility is the most widespread, dominant limitation on yields of maize (*Zea mays* L.) and the sustainability of cereal/ maize-based cropping systems in Africa (Ajayi *et al.*, 2007). However, leguminous trees that are nitrogen fixing trees are known to play complementary or alternative role as source of organic fertilizer and have the potential to sustain soil fertility (Giller, 2001; Snapp *et al.*, 2003; Adjei-Nsiah *et al.*, 2004). Cultivation of leguminous tree crops or biomass transfer is the main possibility for soil enrichment with nutrients, especially with nitrogen.

In many tropical agricultural systems with limited access to fertilizers, tree biomass is often used to meet the Nitrogen (N) requirements of annual crops (Olujobi, 2012). A major challenge in this approach is to

ensure that N in the applied biomass is efficiently utilized by crops. Synchronizing release of N from decomposing biomass with demand (uptake) by crop (Swift, 1987) will lead to increased N-use efficiency of the incorporated biomass (Becker *et al.*, 1994a), and will in turn minimize the opportunity for N loss (Myers *et al.*, 1994).

Xu *et al.* (1993) and Kamara *et al.* (1994) established that the N supply by the biomass transfer from the legumes was not sufficient to achieve optimum companion crop growth and yield in semi-arid tropics. In agroforestry systems, plant residues in form of tree leaf litter or biomass transfer enter the soil system which serves as sources of nutrients and organic matter when they decompose and could contribute to the maintenance of soil fertility.

The only alternative way out of this problem by small landholder agroforestry farmers, is the substitution of costly inorganic farming with low cost organic farming through biomass transfer or mulch. Therefore, it is necessary for farmers to know the benefits of using leafy biomass of leguminous trees and utilizes them in order to meet up with maximum demand of the companion agricultural crops (Olujobi and Oyun, 2013). Though, inorganic fertilizers feed the plant faster but leads to soil degradation, increase soil acidity whereas, organic materials help to increase organic content of the soil of which inorganic fertility will not do. Organic material has various derivable benefits, such as it enhance Cations Exchange Capacity (CEC), improve the structure of the soil, ameliorate and increase crop production and yield, improve soil chemical, physical and biological properties.

Technologies that combine mineral fertilizers with organic nutrient sources can be considered as better options in increasing fertilizer use efficiency, and providing a more balanced supply of nutrients (Donovan and Casey 1998). Combination of organic and mineral fertilizer nutrient sources has been shown to result in synergistic effects and improved synchronization of nutrient release and uptake by crop (Palm *et al.*, 1997) leading to higher yields; especially when the levels of mineral fertilizers used are relatively low (Kapkiyai *et al.*, 1998).

MATERIALS AND METHODS

Study Area

The study area is Makera, a village in Dutsinma Local Government Area of Katsina State, having an area of 527 km², altitude of 605 m and a population of 169, 671 and is found within Latitude 12°27'18" N and Longitude 07°29'29"E. It is also found in the basement complex derived soils of Katsina State (Oguntinyinbo, 1983).

Experimental Design

The experiments were laid in split-split plot design in 3 x 4 x 2 factorials with three replicates. The plot dimensions were 4 m x 3 m. Leafy biomass of *Albizia lebbbeck* and *Parkia biglobosa* were pruned and incorporated fresh into the soil at the rate of 6 kg for each of the *Albizia* and *Parkia* biomass plots (B₁ and B₂) respectively and plots without incorporation of leafy biomass (B₀). The leafy biomass was incorporated into the soil for two cropping seasons (2014 and 2015). Four levels of N fertilizers were split applied as: N₀, 0 kg N ha⁻¹ (control); N₁, 40 kg N ha⁻¹; N₂, 80 kg N ha⁻¹; N₃, 120 kg N ha⁻¹ and were applied at 2 weeks after planting (WAP). The remaining amount was applied 5 WAP. The two varieties of maize used were (DMR- ESR- 7 (Yellow Maize) and 2009 EVAT (White Maize) obtained from Katsina State Agricultural and Rural Development Authority (KTARDA). The two maize varieties were planted (two maize seeds were planted per hole, at equal depth and it was later thinned to one) by conventional spacing of 75 cm x 25 cm two weeks after incorporation of leafy biomass of *Albizia* and *Parkia* into the soil. Thinning was also done 2 WAP making the total plant population of 64 stands per plot.

Plant Tissue Analysis of Agroforestry Tree Species

Samples of harvested leaves were air dried at room temperature and powdered to be analysed for initial contents of N, C, lignin and polyphenols. Total N was analysed by Macro-Kjeldahl digestion, followed by distillation and titration (Anderson and Ingram, 1993; Brandstreet, 1965). Lignin levels were determined by the Acid Detergent

Fibre (ADF) method as outlined in (Anderson and Ingram, 1993). The polyphenol was extracted in hot (80⁰ C) 50 % aqueous methanol and determined calorimetrically with tannic acid as a standard measurement (Anderson and Ingram, 1993; Hagerman, 1988).

Data Collection

Five maize plants were randomly selected within each of the net plots 4 m x 1.5 m (6 m²) with a tag for periodic observations at 4, 6, 8 and 10 WAP during the crop growth cycle for pre- harvest data collection. At harvest, these same five tagged plants were still used to obtain yield.

Statistical Analysis

Data were analysed by subjecting to Analysis of Variance (Factorial) using Statistical Analysis System (SAS, 2000) computer package at 5 % level of significance to determine differences in the treatment effect. The Duncan's Multiple Range Test (Duncan, 1955) was used to separate means of differences among the treatments.

RESULTS

Selected Soil Physical and Chemical Properties before Planting

Soil physical and chemical properties before the commencement of the experiment were presented in Table 1. The soil was low in total nitrogen and organic carbon with 0.04 % and 0.53 % respectively. The soil distribution of exchangeable basic cations follows this order: Ca>Mg>Na>K. Nitrate-nitrogen was higher than ammonia-nitrogen in the soil. The pH of the soil was acidic. The soil belongs to the textural class sandy loam.

Chemical composition of *Albizia lebbeck* and *Parkia biglobosa* leafy biomass

The plant materials showed variations in their chemical compositions during 2014 and 2015 cropping seasons. The leaves of *Albizia lebbeck* contained more N (leading to lower C: N ratio) than *Parkia biglobosa*. *Albizia lebbeck* had the highest concentration of lignin with mean value of 11.06, while *Parkia biglobosa* had highest concentration of C: N ratios with mean value of 6.30. The result in (Table 2) showed that *Parkia biglobosa* had low N and C contents.

Table 1: Soil physical and chemical properties before establishment of the experiment at Makera in 2014

| Soil properties | Value |
|---|---------------|
| Particle size (gkg ⁻¹) | |
| Sand | 88.60 |
| Silt | 4.00 |
| Clay | 7.40 |
| Textural class | Sandy loam |
| Chemical properties | |
| pH | 4.10 (acidic) |
| Organic carbon (%) | 0.53 |
| Total nitrogen (%) | 0.04 |
| NH ₄ ⁺ N (mgkg ⁻¹) | 23.99 |
| NO ₃ ⁻ N(mgkg ⁻¹) | 26.38 |
| Available phosphorus (mg kg ⁻¹) | 7.94 |
| Exchangeable bases (C mol kg ⁻¹) | |
| Ca | 6.25 |
| Mg | 1.01 |
| K | 0.20 |
| Na | 0.35 |
| Exchangeable acidity (C mol kg ⁻¹) | |
| Al ⁺ | 0.15 |
| CEC | 7.96 |
| Micro nutrients (mg kg ⁻¹) | |
| Mn | 30.10 |
| Fe | 11.00 |
| Cu | 1.45 |
| Zn | 6.50 |

Table 2: Chemical composition of the leafy biomass of *Albizia lebbeck* and *Parkia biglobosa*

| Component | N % | C % | Lignin % | Polyphenol % | C: N |
|--------------------------------|-------|--------|----------|--------------|-------|
| <i>Albizia lebbeck</i> | | | | | |
| 2014 | 3.32a | 18.62a | 11.37a | 0.65b | 5.60b |
| 2015 | 3.16a | 18.65a | 10.74a | 0.48b | 5.90b |
| Means | 3.24a | 18.64a | 11.06a | 0.57b | 5.75b |
| <i>Parkia biglobosa</i> | | | | | |
| 2014 | 2.85b | 17.81b | 8.35b | 0.87a | 6.20a |
| 2015 | 2.44b | 15.52b | 8.13b | 0.63a | 6.40a |
| Means | 2.65b | 16.67b | 8.24b | 0.75a | 6.30a |

N= Nitrogen; C= Carbon; C:N= Carbon/Nitrogen ratio

Means followed by the same letter(s) within the same column and treatment are not significantly different (P > 0.05)

Plant Height

Plots amended with *Albizia lebbeck* was consistently having significant higher values of plant height than other treatments at all sampling periods in 2014 (year 1). In 2015 (year 2) at 4 WAP there was no significant difference between plots amended with *Albizia lebbeck* and *Parkia biglobosa*, but control was significantly higher than *Albizia lebbeck* and *Parkia biglobosa*. At 6 WAP, *Parkia biglobosa* was significantly lower than *Albizia lebbeck* and control. At 8 WAP, *Albizia lebbeck* amended plots was significantly higher than *Parkia biglobosa* and control, while at 10 WAP, *Parkia biglobosa* had significant lower value compared with *Albizia lebbeck* and control. In 2014 (year 1), the control treatment produced significantly lower values of plant height than in other plots supplied with nitrogen. Among the nitrogen treated plots, the values were mostly comparable but numerically higher with increase in N rate. In 2015, plots supplied with 80 kg N ha⁻¹ had significant higher value of plant height at 6 WAP and 10 WAP,. There was no significant difference among maize varieties at 4 and 6 WAP, but 2009 EVAT was significantly higher than DMR- ESR-7 at 8 and 10 WAP in 2014 and 2015 (Table 3).

Number of Leaves per Plant

Consistently, plots amended with *Albizia lebbeck* had significantly higher value of number of leaves per plant than other treatments at all sampling periods except at 4 WAP in 2015 where control had significant higher value than both *Albizia lebbeck* and *Parkia biglobosa*. In 2014, at 4, 6 and 10 WAP, control treatment produced significant

lower values of number of leaves per plant than in other plots supplied with nitrogen. No significant response to N rate at 8 WAP. Also, there was no significant response to N rate in 2015. At 8 and 10 WAP, DMR-ESR-7 had less number of leaves than 2009 EVAT. In 2015, at 10 WAP, DMR-ESR-7 had lower value than 2009 EVAT (Table 4).

Leaf Area Index (LAI)

Albizia lebbeck amended plots consistently had significantly higher values of leaf area index than other treatments at all sampling periods in 2014. In 2015, the values were comparable, but *Albizia lebbeck* had significant higher value of leaf area index at 8 WAP compared with other treatments. In 2014 and at 10 WAP in 2015, the control treatments produced significantly lower values of leaf area index than in other plots supplied with nitrogen. 2009 EVAT produced significant higher value of leaf area index at 8 and 10 WAP in 2014 and 10 WAP in 2015 (Table 5).

Total Dry Matter (TDM)

Plots amended with *Albizia lebbeck* had consistent significant higher values of dry matter than other treatments at all sampling periods in 2014 and 2015 (Table 6). In 2014, the control treatment produced significantly lower values of dry matter than in plots supplied with nitrogen. Among the nitrogen treated plots the values were mostly comparable but numerically higher increase in N rate. In 2015, plots supplied with 120 kg N ha⁻¹ had increasing values of total dry matter at 6, 8 and 10 WAP. There was no significant difference among varieties in 2014, while in 2015 at 8 and 10 WAP DMR-ESR-7 had less values than 2009 EVAT.

Table 3: Influence of leafy biomass and nitrogen rate on plant height (cm) of two maize varieties in 2014 and 2015

| Treatment | Plant height | | | | | | | |
|--------------------------------------|--------------|--------|--------|---------|-------|-------|--------|---------|
| | 2014 | | | | 2015 | | | |
| | 4 WAP | 6 WAP | 8 WAP | 10 WAP | 4 WAP | 6 WAP | 8 WAP | 10 WAP |
| Biomass (B) | | | | | | | | |
| Control | 53.5b | 109.5b | 152.7b | 165.6ab | 42.8a | 69.3a | 89.7b | 161.3a |
| Albizia | 68.7a | 133.1a | 169.5a | 174.3a | 38.0b | 70.4a | 105.5a | 160.2a |
| Parkia | 56.8b | 112.5b | 147.6b | 154.1b | 35.2b | 61.9b | 82.8b | 145.0b |
| SE± | 2.50 | 6.48 | 6.34 | 6.44 | 1.42 | 2.00 | 4.77 | 4.28 |
| Nitrogen(N)Kg ha⁻¹ | | | | | | | | |
| 0 | 55.8a | 82.9b | 123.7b | 133.6b | 38.3a | 64.2b | 87.0a | 144.6b |
| 40 | 61.1a | 122.3a | 160.2a | 169.9a | 39.8a | 66.8b | 93.8a | 157.5ab |
| 80 | 61.0a | 131.0a | 167.8a | 172.6a | 37.8a | 73.2a | 99.3a | 159.5a |
| 120 | 60.7a | 137.2a | 174.8a | 182.6a | 38.8a | 64.5b | 90.7a | 160.4a |
| SE± | 3.26 | 5.97 | 6.18 | 6.37 | 1.83 | 2.33 | 5.99 | 5.19 |
| Variety (V) | | | | | | | | |
| DMR- ESR- 7 | 60.9a | 121.9a | 150.8b | 158.3b | 38.6a | 65.9a | 94.1a | 148.1b |
| 2009 EVAT | 58.3a | 114.8a | 162.4a | 171.0a | 38.8a | 68.5a | 91.3a | 163.0a |
| SE± | 2.30 | 5.58 | 5.36 | 5.34 | 1.29 | 1.74 | 4.25 | 3.56 |
| Interaction | | | | | | | | |
| B x N | S* | S* | NS | S* | NS | S* | S* | S* |
| B x V | S* | S* | S* | NS | S* | S* | S* | S* |
| V x N | NS | S* | S* | S* | NS | S* | NS | S* |

Means followed by the same letter(s) within the same column and treatment are not significantly different at 5 % level of probability using DMRT.

WAP: Weeks after planting. S* Significant at 5 % level of probability. NS: Not significant.

Table 4: Influence of leafy biomass and nitrogen rate on number of leaves (cm) of two maize varieties in 2014 and 2015

| Treatment | Number of leaves per plant | | | | | | | |
|---------------------------------------|----------------------------|-------|-------|--------|-------|-------|-------|--------|
| | 2014 | | | | 2015 | | | |
| | 4 WAP | 6 WAP | 8 WAP | 10 WAP | 4 WAP | 6 WAP | 8 WAP | 10 WAP |
| Biomass (B) | | | | | | | | |
| Control | 8.5b | 11.5b | 12.7b | 11.6b | 7.6a | 8.7a | 10.7a | 10.8a |
| Albizia | 10.0a | 13.2a | 13.9a | 12.7a | 7.5ab | 8.6a | 10.7a | 10.7a |
| Parkia | 8.9b | 12.0b | 13.1b | 11.8b | 7.0b | 8.2a | 10.1b | 10.3a |
| SE± | 0.27 | 0.24 | 0.28 | 0.29 | 0.21 | 0.25 | 0.18 | 0.24 |
| Nitrogen(N) Kg ha⁻¹ | | | | | | | | |
| 0 | 8.4b | 11.4b | 13.0a | 11.0b | 7.3a | 8.5a | 10.5a | 10.3a |
| 40 | 9.4a | 12.4a | 13.2a | 12.1a | 7.5a | 8.8a | 10.5a | 10.7a |
| 80 | 9.2ab | 12.6a | 13.5a | 12.4a | 7.2a | 8.3a | 10.4a | 10.7a |
| 120 | 9.6a | 12.6a | 13.3a | 12.7a | 7.4a | 8.4a | 10.6a | 10.5a |
| SE± | 0.32 | 0.30 | 0.35 | 0.33 | 0.26 | 0.29 | 0.22 | 0.27 |
| Variety (V) | | | | | | | | |
| DMR- ESR- 7 | 9.1a | 12.1a | 12.7b | 11.5b | 7.1a | 8.4a | 10.5a | 9.9b |
| 2009 EVAT | 9.2a | 12.4a | 13.8a | 12.6a | 7.6a | 8.6a | 10.5a | 11.3a |
| SE± | 0.24 | 0.23 | 0.22 | 0.24 | 0.17 | 0.21 | 0.16 | 0.15 |
| Interaction | | | | | | | | |
| B x N | S* | S* | NS | S* | NS | NS | NS | NS |
| B x V | S* | S* | S* | NS | S* | NS | NS | S* |
| V x N | S* | S* | NS | NS | NS | NS | NS | S* |

Means followed by the same letter(s) within the same column and treatment are not significantly different at 5 % level of probability using DMRT WAP: Weeks after planting. S* Significant at 5 % level of probability. NS: Not significant.

Table 5: Influence of leafy biomass and nitrogen rate on leaf area index (LAI) of two maize varieties in 2014 and 2015

| Treatment | Leaf area index | | | | | | | |
|---------------------------------------|-----------------|--------|--------|---------|---------|--------|---------|--------|
| | 2014 | | | | 2015 | | | |
| | 4 WAP | 6 WAP | 8 WAP | 10 WAP | 4 WAP | 6 WAP | 8 WAP | 10 WAP |
| Biomass (B) | | | | | | | | |
| Control | 0.187b | 0.106b | 0.184b | 0.190ab | 0.100a | 0.485b | 0.748b | 0.865a |
| Albizia | 0.233a | 0.164a | 0.221a | 0.215a | 0.087ab | 0.630a | 0.879a | 0.906a |
| Parkia | 0.196b | 0.114b | 0.192b | 0.178b | 0.081b | 0.518b | 0.779ab | 0.699b |
| SE± | 0.0139 | 0.0076 | 0.0136 | 0.0139 | 0.0054 | 0.0236 | 0.0422 | 0.0443 |
| Nitrogen(N) Kg ha⁻¹ | | | | | | | | |
| 0 | 0.129b | 0.105b | 0.127b | 0.124b | 0.084a | 0.513a | 0.720a | 0.693b |
| 40 | 0.214a | 0.133a | 0.214a | 0.200a | 0.092a | 0.540a | 0.792a | 0.857a |
| 80 | 0.248a | 0.134a | 0.226a | 0.226a | 0.091a | 0.585a | 0.857a | 0.847a |
| 120 | 0.230a | 0.140a | 0.230a | 0.228a | 0.091a | 0.538a | 0.839a | 0.897a |
| SE± | 0.0128 | 0.0103 | 0.0124 | 0.0129 | 0.0066 | 0.0306 | 0.0494 | 0.0536 |
| Variety (V) | | | | | | | | |
| DMR- ESR- 7 | 0.195a | 0.131a | 0.187b | 0.181b | 0.088a | 0.518a | 0.787a | 0.746b |
| 2009 EVAT | 0.215a | 0.125a | 0.211a | 0.209a | 0.091a | 0.571a | 0.817a | 0.091a |
| SE± | 0.0118 | 0.0075 | 0.0112 | 0.0114 | 0.0047 | 0.0176 | 0.0347 | 0.0375 |
| Interaction | | | | | | | | |
| B x N | S* | S* | S* | S* | NS | S* | S* | S* |
| B x V | S* | S* | S* | S* | S* | S* | NS | S* |
| V x N | S* | S* | S* | S* | NS | NS | NS | S* |

WAP: Weeks after planting. S* Significant at 5 % level of probability. NS: Not significant.

Means followed by the same letter(s) within the same column and treatment are not significantly different at 5 % level of probability using DMRT.

Table 6: Influence of leafy biomass and nitrogen rate on total dry matter (TDM) per plant (g) of two maize varieties in 2014 and 2015

| Treatment | Total dry matter per plant | | | | | | | |
|---------------------------------------|----------------------------|--------|--------|---------|-------|-------|--------|---------|
| | 2014 | | | | 2015 | | | |
| | 4 WAP | 6 WAP | 8 WAP | 10 WAP | 4 WAP | 6 WAP | 8 WAP | 10 WAP |
| Biomass (B) | | | | | | | | |
| Control | 13.9c | 58.0b | 88.3b | 123.5b | 7.0a | 60.9b | 87.4b | 130.8a |
| Albizia | 21.9a | 81.3a | 116.1a | 157.8a | 6.3a | 83.4a | 107.5a | 127.0a |
| Parkia | 18.7b | 67.3ab | 93.9b | 136.5ab | 5.8a | 41.5c | 65.9c | 94.5b |
| SE± | 1.09 | 6.42 | 8.48 | 12.63 | 0.57 | 4.95 | 6.96 | 8.79 |
| Nitrogen(N) Kg ha⁻¹ | | | | | | | | |
| 0 | 15.1c | 49.0b | 66.9b | 87.0b | 6.2a | 57.6b | 81.5b | 101.2b |
| 40 | 16.7bc | 75.0a | 109.5a | 140.7a | 6.5a | 52.6b | 73.8b | 106.3b |
| 80 | 18.7ab | 68.7ab | 106.9a | 155.7a | 6.8a | 55.9b | 78.5b | 125.0ab |
| 120 | 22.0a | 82.8a | 114.5a | 173.7a | 6.1a | 81.5a | 113.8a | 137.2a |
| SE± | 1.36 | 7.04 | 8.97 | 12.49 | 0.71 | 6.50 | 8.15 | 10.32 |
| Variety (V) | | | | | | | | |
| DMR- ESR- 7 | 18.1a | 68.0a | 96.7a | 145.2a | 6.4a | 57.2a | 77.7b | 102.6b |
| 2009 EVAT | 18.2a | 69.8a | 102.2a | 133.3a | 6.4a | 66.6a | 96.1a | 132.3a |
| SE± | 1.07 | 5.41 | 7.18 | 10.52 | 0.50 | 4.78 | 5.98 | 7.28 |
| Interaction | | | | | | | | |
| B x N | S* | S* | S* | S* | S* | S* | S* | S* |
| B x V | S* | S* | NS | S* | NS | S* | S* | S* |
| V x N | S* | S* | S* | S* | NS | S* | S* | S* |

WAP: Weeks after planting. S* Significant at 5 % level of probability. NS: Not significant.

Means followed by the same letter(s) within the same column and treatment are not significantly different at 5 % level of probability using DMRT.

DISCUSSION

Incorporation of *Albizia lebbeck* biomass performed better due to better quality materials which are resident in it. It contain higher average N content of (3.24 %) and (18.64 %) and lower average C: N (5.75) (Table 2) than *Parkia biglobosa* materials (Giller and Wilson, 1991; (Oyebamiji *et al.*, 2017), also reported that plant residues with a smaller C: N (< 30:1) is liable to decompose more rapidly with a net mineralization of N after incorporation into the soil. Hence, N is rapidly released and made readily available for crops.

The general performance of maize plants was discovered to be higher in *Albizia lebbeck* on plant height, number of leaves per plant, leaf area index and total dry matter per plant. Maize plants in plots that received biomass performed better than the control. This tremendous performance was noted by their higher or taller plant, large number of leaves, higher leaf area index and more dry matter plant in *Albizia lebbeck* amended plots than in plots with *Parkia biglobosa*. The better performance in terms of growth in biomass treated plots contributed to the increase in the amount of N fixed by the biomass and quantity of N derived from the decomposition of the incorporated biomass. Green manure in form of biomass or litter generally has the capacity to improve soil nitrogen content (Push-pavalli *et al.*, 1994) because nitrogen is widely recognized as the major macro nutrient required for plant growth.

The response of maize to nitrogen application agrees with Daudu (2004) and Cherr *et al.*, (2006) that maize growth is significantly influenced by biomass or litter used. Vegetative growth and development of maize was stimulated by the application of nitrogen which enhanced the increase as observed in plant height, number of leaves, leaf area index and total dry matter per plant. Increase in growth components revealed the essentiality of nitrogen as a protein constituent and important component of many other compounds needed for plant growth processes (Onasanya *et al.*, 2009). The poor plant growth and low productivity observed in

control was due to poor photosynthetic activity for its optimum production.

However, 2009 EVAT and DMR-ESR-7 were both similar in terms of vegetative and yield characters, and this agrees with Namakka (2002) who reported that the growth components of these maize varieties have the same genetic make-up except in their colour differences (white and yellow).

CONCLUSION

The soil is sandy loam and acidic in nature. Incorporation of *Albizia lebbeck* into the soil improved the soil quality for better growth. However, application of 120 kg N ha⁻¹ is found to be the best and suitable rate for both 2009 EVAT and DMR-ESR-7 maize production. The use of biomass alone can enhance growth in maize but better when combined with nitrogen fertilizer.

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