EVALUATION OF *Albizia lebbeck* LEAF AND BARK EXTRACTS ON THE GROWTH AND YIELD OF MAIZE (*Zea mays* L.)

[1]ADEMOLA, J.A., [2]ADEMOLA, O.C., [1]ADEREMI, F.T., [1]ELESHO, R.O. AND [1]KAREEM, A.T.
[1]Federal College of Forestry, Ibadan; Forestry Research Institute of Nigeria, Ibadan.
[2]Forestry Research Institute of Nigeria, Ibadan.
Email of correspondence: ademolajoshua08@gmail.com

ABSTRACT

The issue of Soil nutrient depletion is indeed a significant concern in agriculture, leading to poor crop yields and decreased fertility. The use of synthetic and organic manures has been explored to address this issue, but some of these solutions have had unintended negative consequences, such as: Soil degradation, Water pollution, Reduced soil biodiversity, Negative impacts on human health. This study therefore investigated the potential of aqueous extracts from the bark and leaves of *Albizia lebbeck* as liquid fertilizers for promoting the growth and yield of maize. Aqueous extract source (leaf and plant bark), application rates of plants part and four application rates (100ml, 200ml, 300ml and 400ml) per plant, organic fertilizer, inorganic fertilizer and control. The experiment was replicated three times. The experiment was laid out in complete randomized design (CRD). Data collected on growth and yield parameters were Plant Height (PH), Number of Leaves (NL), Stem Girth (SG), Leaf Area (LA), Cob length (CL), Fresh Cob weight (FCW), Dry Cob Weight (DCW) and Weight Per100grains (WPG) were measured at 2weeks interval. Data collected were subjected to Analysis of Variance using SAS 2002 and means were separated using Duncan Multiple Range Test (DMRT) at $P \leq 0.05$. The maize plant treated with *A.lebbeck* bark at 20% and 10% concentration had the highest value for the aqueous extract plant height (190.3cm) and leaf area (720.8cm) respectively while inorganic fertilizer had the highest stem girth (19.3cm).For yield parameters, *Albizia lebbeck bark* aqueous extract at 30% concentration had the highest dry weight (36.7g), cob length (11.3g), and seed weight (29.3g) respectively. . Conclusively, the application of leaf and bark extracts of *Albizia lebbeck* at different concentration as soil supplement brought about improvement in the soil fertility, evident from the growth and yield of maize. These tree species on farmland, under agroforestry system are helpful to increase the performance of maize. It is therefore recommended that *Albizia lebbeck* leaf aqueous extract at 30% concentration be used for Oba super 6 maize hybrid cultivation.

Keywords: soil nutrient, organic manure, soil fertility, *Albizia lebbeck*, plant extracts

INTRODUCTION

Agriculture is the primary economic activity in Nigeria, which directly contributes 26% of the GDP and another 25% indirectly while also accounting for more than 70% of informal employment in the rural areas (Ovwigho, 2014). The sector also provides food security and livelihood for over 80% of the Nigerian population. It is therefore not only the driver of Nigeria's economy but also the means of livelihood for the majority of Nigerian people (Agbarevo and Nmeregini, 2019). Nigeria is blessed with land, water and forest resources all of which contributes immensely to the benefit the country derives from agriculture. Out of these, the forest resources have only been extensively explored for timber purposes and as such limiting the other potentials derivable from the forest resources.

Over the years, population pressure and the dependency on the agricultural sector in Nigeria has increased pressure on land resources, resulting in declining soil fertility, productivity and general environmental degradation (Mati, 2005). A significant decline in soil fertility on farms across Nigeria due to continuous cultivation has been widely reported (Rosen, 2009; Solomon *et al*., 2007). Low soil fertility, poor crop husbandry and use of unimproved seeds among others have led to declining yields (Lobell *et al*., 2009).

Although extracts from various parts of forest trees have been known to possess diverse medicinal and biological activity on human and animals, little is known scientifically about the potential effect of forest trees as growth enhancers in major crop plants because very few published literatures are available that clearly explain the effects of tree part extract in plants (Nailul*et al*., 2018). It has been widely hypothesized that leaf extract from some tree species possess a number of plant growth promoters, mineral nutrients and vitamins in a naturally balanced composition which can be exploited for plant growth and development purposes (Abdalla, 2013). Literature have it that groups of secondary metabolite compounds have been isolated from different plants and trees plants and used as bio-stimulants; some of these include triterpenoid and saponin (Andresen and Cedergreen, 2010), flavonoid (Prabhu, *et al*., 2010), and alkaloid (Aniszewski, 2007).

Albizia lebbeck (L.) Benth (*Mimosoideae*), commonly called Indian Siris or East Indian walnut, is one of the most promising fodder trees for semi-arid regions (Gupta *et al*., 2004). The tree is used in folk remedies in bolus, enemas, ghees or powders for abdominal tumors. Reported to be pectoral astringent, rejuvenant and tonic, the siris tree is a folk remedy for boils, cough, flu and eye and lung ailments. The seed oil is used for leprosy and the powdered seed in scrofulous swelling. The ethanolic extracts of *A. lebbeck* leaves exhibited anticonvulsant activity (Kasture *et al*., 2000) Agricultural usage.

The study therefore aimed to investigate the effects of the leaf and bark aqueous extracts of *Albizia lebbeck* on growth and yield maize.

MATERIALS AND METHOD

Study Area

The experiment was carried out at Teaching and Research Farm of Federal College of Forestry, Ibadan. Latitude 7°23'N and longitude 3°51'E with an annual rainfall ranging between 1300- and 1500-mm. Average temperature of 26°C and relative humidity of between 65%- 85% (FRIN, Meteorological Station, 2012).

Sowing Media

Twenty (20) kg of topsoil was thoroughly sieved using a 2 mm sieve filled into polythene sack. A small portion of it was taken to the laboratory for pre and post planting soil analysis. A total of thirty-three (33) polythene pots were used in the study. Two (2) maize seeds of Oba super 6 hybrid were planted in each pot and then thinned to one plant per pot.

Cultural Practice

Clearing, manual weeding, thinning and supplying were cultural practices used.

Preparation of Plant Extracts

The aqueous extract of *Albizia lebbeck* was prepared from their fresh leaves and the bark. One kilogram of leaves and the bark was manually ground into paste and sieved with muslin cloth. Also, 20kg of topsoil was thoroughly sieved using a 2mm sieve filled into polythene sack. A small portion of it was taken to the laboratory for pre and post planting soil analysis. Two seeds of oba super 6 maize hybrids were planted per bag. The filtrate was diluted to different concentrations (10 %, 20 %, 30 % and 40 %). The same procedure was repeated for the bark extracts of the plants (Partey, 2010; Nalunga, 2014).

Experimental Design and Treatments

The experimental design used was complete randomized design (CRD) with eleven (11) treatments and replicated thrice.

Treatments

T1: *A. lebbeck* leaf extract @ 10%
T2: *A. lebbeck* leaf extract @ 20%
T3 *A. lebbeck* leaf extract @ 30%
T4: *A. lebbeck* leaf extract @ 40%
T5: *A. lebbeck* bark extract @ 10%
T6: *A. lebbeck* bark extract@ 20%
T7: *A. lebbeck* bark extract@ 30%
T8: *A. lebbeck* bark extract @ 40%
T9: Inorganic fertilizer (C-Maxi force)
T10: Organic fertilizer
T11: Control (no extract and no fertilizer)

Data collection

Data were collected on the following growth and yield parameters on each plant: Plant height (cm), Number of leaves, Stem girth (cm), Leaf Area (cm^2), Cob length (cm), Fresh cob weight (g), Dry cob weight (g), 100 grain weight (g)

Statistical Analysis

The data collected were subjected to Analysis of variance (ANOVA) and means were separated using Duncan Multiple Range Test (DMRT) with SAS 2002 Version at 5 % probability level.

RESULTS

The physical and chemical properties of the experimental soil before and after planting

The soil pH ranged from 5.45 to 5.55 pre- and post-planting, respectively. This indicates the soil was slightly acidic both before and after cultivation. The optimal pH range for most tropical crops is reported between 6.0-7.5 (Havlin *et al*., 2005). The slight increase in pH after planting could be due to nutrient uptake by the crops and additions of organic matter which release hydroxyl ions, thereby reducing acidity (Brady and Weil, 2008).

Organic carbon content increased from 1.21% to 1.44% pre- and post-planting, respectively. Increases in soil organic carbon through leaf and root biomass additions have been well documented (Lal, 2004). This demonstrates the crops were effective in adding organic matter back to the soil. Optimal organic carbon levels in tropical soils are reported between 1-3% (Havlin *et al*., 2005). Both readings fall within the normal range, but the post-planting increase moves the soil closer to optimum levels for nutrient retention and soil structure formation (Brady and Weil, 2008).

Total nitrogen and phosphorus levels increased slightly from 0.102% to 0.132% and 1.332 to 1.432 mg/kg, respectively, after cultivation, indicating uptake and utilization of these essential macronutrients by the crops (Havlin *et al*., 2005). Standard nitrogen and phosphorus levels for tropical soils are reported as 0.15-0.25% and 10-30 mg/kg, respectively (Brady and Weil, 2008). Both nutrients remain below optimal levels even after cultivation, suggesting future amendments may be needed to support optimum crop yields.

Key cations calcium, magnesium and potassium did not change significantly after planting and their levels pre- and post-planting fall within normal ranges reported for tropical soils of 2-10 Cmol/Kg for calcium and magnesium, and 0.1-1 Cmol/Kg for potassium (Havlin *et al*., 2005).

Acidity levels decreased from 1.6 to 1.4 Cmol/Kg with no change in aluminum levels. Reductions in soil acidity through crop cultivation have been documented previously (Brady and Weil, 2008).

Physicochemical properties of the extracts

The physicochemical compositions of the plant extracts are shown in Table 2. *A. lebbeck* bark had higher concentrations of phosphorus, potassium, manganese, zinc, copper and iron and had a slightly higher pH value. The EC concentration in the bark was also very higher than in the leaf of *A. lebbeck* with the bark containing higher proportions of the nutrient elements except for nitrogen which was higher in the leaves of same plant.

Effect of *A. lebbeck* leaf and bark aqueous extracts on the growth of maize plants

Plant height

In Table 3, there was significant difference among the treatments. The result revealed that maize treated with inorganic fertilizer had the highest plant height of 27.3cm which is statistically the same as maize treated with *A. lebbeck bark* (22.3)at 20% concentration at 2 weeks after planting (WAP), at 4, 6 and 8 WAP, *A. lebbeck* bark extract at 20% concentration had the highest plant height of 64.0cm, 142.0cm and 190.3cm respectively, at 8 WAP however, the leaf extract of the same plant (20%) had the same significant result with the bark. The result further revealed that maize plant under *A. lebbeck bark* at 40% maintained its least performance till 8 WAP (134.0cm).

Number of leaves

As presented in the table 4, there was no significant difference among the treatments the rate of application at 2 WAP, however *A. lebbeck* bark extracts at 10 and 20 % concentrations had the highest number of leaves. The result revealed that maize treated with *A. lebbeck* at 10% concentration had the highest mean number of leaf (13.3 and 16.7) at 4 and 6 WAP respectively while *A. lebbeck* leaf at 10% had the highest leaves at 8 WAP. Meanwhile, maize seedlings under *A. lebbeck* leaf at 30% had the least number of leaf at 2 and 4 WAP, similar result was observed in *A. lebbeck* bark at 40% at 6. However, at 8 WAP, maize seedlings under organic fertilizer and control both had the least number of leaf (16).

Leaf area

As presented in Table 5, there was a significant difference among the treatments and the rate of application. The result revealed that the maize treated with aqueous extract under *A. lebbeck* leaf at 30% concentration had the highest leaf area of 121.0cm^2, at 2 WAP, *A. lebbeck* bark extract had the highest leaf area at 4 and 8 WAP while the control had the highest leaf area at 4 WAP. Meanwhile, maize seedlings under *A. lebbeck* leaf at 10% had the least leaf area throughout the experiment except at 2 WAP where *A. lebbeck* leaf at 40% had the least mean leaf area of 62.3cm^2.

Stem girth

As presented in the table 6, there was significant difference among the tested plants extracts and the rate of application. The result revealed that the seedlings under inorganic fertilizer had the highest stem girth that is statistically the same as *A. lebbeck* leaf at 20% concentration throughout the experiment except at 2 WAP where *A. lebbeck* bark at 20% having the highest stem girth. At the other end, *A. lebbeck* leaf at 10% concentration had the lowest stem girth throughout the experiment except the same plant at 40% concentration at 2 WAP (5.2).

Effect of *A. lebbeck* leaf and bark aqueous extracts on the yield of maize plants

Fresh weight

The yield of *maize* varied significantly among the different extracts applied and the control. The result revealed that the seedlings under *A. lebbeck* bark at 10% concentration had the highest mean fresh weight of 60.3g, this is followed by *A. lebbeck* leaf at30% having mean fresh weight of 60.0g while the control had the least mean fresh weight of 23.0g.(Table 4.7)

Dry Weight

Maize seedlings under *A. lebbeck bark* at 30% had the highest mean dry weight of 36.7g followed by *A. lebbeck* bark at 10% concentration having weight of 31.3g. Maize seedlings under control and inorganic fertilizer had the least mean dry weight of 8.0g.

Cob Length

The result of the cob length revealed that maize cob under *A. lebbeck bark* at 30% had the highest mean cob length of 11.3 followed by *A. lebbeck* leaf at the same concentrations. Maize cob under control had the least mean dry weight of 7.0g.

Seed Weight per Cob

The result of the seed weight per cob revealed that maize under *A. lebbeck* bark at 30% concentration had the highest mean seed weight per cob of 29.3g, while maize under *A. lebbeck* leaf at 30% closely followed this with a weight of (11.0g). The least seed weight per cob of 12.7g was observed in maize raised under *A. lebbeck* bark at 40% concentration.

Weight per 100 grains

The result of the weight per 100 grains revealed that highest weight per 100 grains of maize (23.3g) was observed under *A. lebbeck* bark at 10%. This is followed by *A. lebbeck leaf* at 20% and organic fertilizer with weight per 100 grains of 20.0g apiece. The least weight per 100 grains of 13.7g was observed in maize under *A. zygia* bark at 40% concentration, *A. lebbeck* bark at 40% concentration and the control.

DISCUSSION

A. lebbeck is a multipurpose tree species which has undergone serious genetic erosion and deforestation consequent upon urbanization, industrialization and agricultural activities. In a bid to facilitate food security at most economical price necessitates the use of cheaper and environmentally friendly means. The application of extracts had significant effects on all of the growth parameters studied and can be ranked in the order of *A. lebbeck* leaf> *A. lebbeck* bark. This implies that extracts application plays a key role in the height of maize, and this was in line with the findings of Nhut *et al.* (2003) and Johkan *et al.* (2012) which state that addition of extracts to seedlings of *Annona muricata* resulted in increased plant height. Increase in plant height at different concentrations of extracts application may be due to increased mineral element received by the plants, this might result from activation of metabolic processes that facilitate or hasten growth. Increased plant height under a higher concentration in Cardinal flower (*Sinningiacardinalis*) has also been reported previously by Hee Kim *et al.* (2015).

The application of *A. lebbeck* leaf and bark extracts had significant effect on plant height of maize variety planted. Meanwhile, leaf extract performed better than the bark extract. This result is also in agreement with earlier research of Armitage (1991) in which increased plant height in various field-grown cut-flower species was experienced at higher concentration which later at a higher concentration began to show some symptoms of yellow discolouration.

This observation is similar to the previous findings of Ali *et al. (*2011) and Abbas *et al. (*2013) who noted a significant increase in the number of leaves of cowpea produced when treated with organo-mineral fertilizer. This resulted from enhanced cell activities as a result of improved soil fertility. The importance of increased number of leaves to plant growth especially in photosynthetic activities which in the long run enhance the total healthy growth of plant. Nevertheless, this result negates the findings of Biswas *et al. (*2016) and Chattha *et al. (*2015) who reported a slight decline in number of leaves of chili when treated with selected organic manure. Besides, results revealed that the leaf of the plants extracts contained more nitrogen than the bark and the roles of nitrogen in biomass accumulation in maize have been established (Ogundare *et al.,* 2015 and Imran *et al*., 2015).

Furthermore, *A. lebbeck* leaf extract also produced comparatively improved growth in stem girth of maize plants. The result of the extract analysis is in contrast with the reports of a number of researchers that leaf extracts from tree species are usually rich in potassium, calcium, iron, amino acids, ascorbates as well as growth regulating hormones such as zea tin than the bark. This may make the leaf extracts from this plant species to be ideal plant growth enhancers (Basra *et al.,* 2009). The performance produced by the leaf extracts of the two species may be ascribed to their contents of Zeatin as was reported by Biswas *et al.* (2016).

The variation in yield among the extract applied in this study might be traced to the differential elemental constituent each extract applied. The best yield in fresh weight, dry weight, seed weight per cob and weight per100 grains was observed in maize under 30% *A. zygia* leaf, while the control where there was no application had least yield of these traits.

This implies that positive correlation does exist between yield and soil nutrient provided the seed is from a good source. This also support the findings of Alma *et al.* (2016) who reported that the correlation analysis between soil nutrition and phenology of *Annona* genera shows that the reproductive phases of *Annona* are associated with changes in precipitation and minimum temperatures and the amount of available nutrient.

This assertion is jointly supported several authors such as Price, (1981) and Mehboob (2011) who reported that application of fertilizers improved the growth and yield of maize compared to the control. The increase in yield could be traced to the ability of the extract to add lacking minerals in the soil and improve microbial activities.

CONCLUSION

The results obtained from this study affirm that the application of leaf and bark extract of *Albizia lebbeck* at different concentrations of 10, 20, 30 and 40% as soil supplement improved the soil fertility evident from the growth and yield increment of maize compared to the control. The significant effect of the extracts on the growth and yield performance of Maize increases as concentrations of the extract increases up to 30% levels.

RECOMMENDATION

The use of these tree aqueous extracts has helped in the soil improvement, growth and yield of the maize. Therefore, it is recommended that *Albizia lebbeck* leaf aqueous extract at 30% concentration be used for Oba super 6 maize hybrid cultivation. Also, the use of these tree species would help in afforestation and prevent extinction of these species.

REFERENCES

Abdalla, M. M. (2013). The potential of *Moringa oleifera* extract as a bio-stimulant in enhancing the growth, biochemical and hormonal contents in rocket (*Eruca vesicaria* subsp. *sativa*). *International Journal of Plant Physiology and Biochemistry*, **5**(3), 42–49.

Agbarevo, M. N. B. and Nmeregini, D. C (2019). Effect of non-farm income-generating activities on poverty reduction among rural households in Abia State, Nigeria. International Journal of Agriculture and Research, **2**(1): 15 -25.

Andresen, M., and Cedergreen, N. (2010). Plant growth is stimulated by tea-seed extract. *Journal of Hort science,* **45**(12): 1848–1853.

Aniszewski, T. (2007). *Alkaloids-secret of Life: Alkaloid Chemistry, Biological Significance, Applications and Ecological Role* (pp. 160–164). Amsterdam: Elsevier.

Brady, N.C. and Weil, R.R., (2008). The nature and properties of soils. 14th ed. Upper Saddle River, N.J: Pearson Prentice Hall.

Havlin, J.L., Beaton, J.D., Tisdale, S.L. and Nelson, W.L., (2005). Soil fertility and fertilizers: An introduction to nutrient management. 7th ed. Upper Saddle River, N.J: Pearson Prentice Hall.

Lal, R., (2004). Soil carbon sequestration impacts on global climate change and food security. Science, 304(5677), pp.1623-1627.

Lobell, D.B., Cassman, K.G. and Field, C.B. (2009). Crop Yield Gaps: Their Importance, Magnitudes, and Causes. *Annual Review of Environment and Resources* **34** (1): 179- 204.

Mati, B. M. (2005). Overview of water and soil nutrient management under smallholder rain fed agriculture in East Africa: Working Paper 105. Colombo, Sri Lanka: International Water Management Institute (IWMI).

Nailul, R. A., Zozy, A. N., Amri, B. and Mansyurdin (2018). Effect of Plant Extracts on Growth and Yield of Maize (*Zea mays* L.). Pertanika J. Trop. Agric. Sc. 41 (3): 1193 – 1205

Nalunga J. (2014): A guide for trainers, Organic Agriculture-Principles and Practices Kampala: Women in Europe for a common future. http://www.wecf.eu/english/publications/2014/Agriculture-guide.php

Ovwigho, B. O. (2014). Factors influencing involvement in non-farm income generating activities among local farmers: The Case of Ughelli South Local Government Area of Delta State, Nigeria. Sustainable Agriculture Research, 3(1): 76 – 84.

Partey S. T. (2010): The Agronomic Qualities of the Mexican Sunflower (Tithonia diversifolia) For Soil Fertility Improvement in Ghana. A Thesis submitted to the Department of Agroforestry, Kwame Nkrumah University of Science and Technology. http://ir.knust.edu.gh/bitstream/123456789/7196/1/THE%20AGRONO MIC%

Prabhu, M., Kumar, A. R. and Rajamani, K. (2010). Influence of different organic substances on growth and herb yield of sacred basil (*Ocimum sanctum* L). *Indian Journal of Agricultural Research*, *44*(1), 48–52.

Rosen, S. (2009). Soil physical properties and erosion risks at smallholder farmers in Embu, Kenya. Bachelor's Thesis. Swedish university of Agricultural science. Department of Soil and Environment.Solomon, D., Lehmann, J., Kinyangi, J., Amelung, W., Lobe, I., Pell, A., Riha, S., Ngoze, S., Verchot, L., Mbugua, D., Skjemstad, J. and Schafer, T. (2007). Long-term impacts of anthropogenic perturbations on dynamics and speciation of organic carbon in tropical forest and subtropical grassland ecosystems. *Global Change Biology* **13**: 511- 530.

Table1: Physical and chemical properties of the experimental soil before and after planting

Parameters	Pre-planting	Post-planting
pH (1:1) H_2O	5.450	5.550
Organic Carbon	1.214	1.442
Nitrogen (%)	0.102	0.132
Phosphorus (mg/Kg)	1.332	1.432
Calcium (Cmol/Kg)	5.047	5.037
Magnesium (Cmol/Kg)	0.872	0.872
Potassium (Cmol/Kg)	0.078	0.079
Sodium (Cmol/Kg)	0.370	0.370
Acidity (Cmol/Kg)	1.600	1.400
Aluminum (Cmol/Kg)	0.000	Na
ECEC (Cmol/Kg)	6.527	6.517
Manganese (mg/Kg)	47.560	47.520
Iron (mg/Kg)	28.230	28.130
Copper (mg/Kg)	10.490	10.440
Zinc (mg/Kg)	1.990	1.960
Sand (%)	86.600	86.600
Silt (%)	5.400	5.400
Clay (%)	8.000	8.000
Textural Classification	Sandy Soil	Sandy Soil

Table 2: Physicochemical composition of the aqueous extract of leaf and bark of *A. lebbeck*

Parameters	*A. lebbeck*	
	Leaf	**Bark**
Ph	5.55	5.60
EC Ns/cm	197.50	1113.55
% N	3.50	3.45
% P	4.73	5.74
%K	0.93	1.84
%Mn	0.05	0.08
% Zn	0.71	0.90
% Cu	0.06	0.09
% Fe	0.08	0.96

Table 3: Plant height (cm) of maize treated with *A. lebbeck* aqueous extracts

		Week After Planting			
Treatments	**Ratio (%)**	**2**	**4**	**6**	**8**
***A. Lebbeek* leaf**	10	16.7^{abc}	38.7^{d}	86.0^{b}	160.0^{bcde}
	20	19.7^{abc}	46.3^{bcd}	101.0^{ab}	190.3^{ab}
	30	17.7^{abc}	39.7^{d}	87.3^{b}	135.0^{de}
	40	13.7^{c}	37.3^{d}	83.3^{b}	134.0^{e}
***A. Lebbeck* bark**	10	20.0^{abc}	53.3^{abcd}	130.0^{ab}	181.0^{bc}
	20	22.3^{ab}	64.0^{a}	142.0^{ab}	190.3^{ab}
	30	20.3^{abc}	51.3^{abcd}	115.7^{ab}	176.7^{bc}
	40	19.0^{abc}	51.7^{abcd}	133.0^{ab}	167.7^{bc}
Organic fertilizer	1.0	19.7^{abc}	47.0^{abcd}	107.0^{ab}	163.0^{bcde}
Inorganic fertilizer	1.3	22.7^{ab}	53.0^{abcd}	122.0^{ab}	178.0^{bc}
Control	0	19.0^{abc}	44.0^{cd}	124.7^{ab}	158.7^{bcde}

Means along the column with the same superscript(s) are not significantly different at 5% probability.

Tables 4: Number of leaves of maize treated with *A. lebbeck* aqueous extracts

		WEEKS AFTER PLANTING			
Treatments	**Ratio (%)**	**2**	**4**	**6**	**8**
A. Lebbeck leaf	10	6.7^{a}	12.3^{abc}	16.3^{abc}	17.7^{ab}
	20	7.3^{a}	12.0^{abcd}	14.7^{def}	17.0^{abc}
	30	6.3^{a}	10.3^{d}	14.3^{ef}	16.3^{bc}
	40	7.0^{a}	12.3^{abc}	15.3^{bcdef}	17.0^{abc}
A. Lebbeck Bark	10	7.7^{a}	13.3^{a}	16.7^{ab}	17.3^{abc}
	20	7.7^{a}	12.3^{abc}	15.3^{bcdef}	17.3^{abc}
	30	7.3^{a}	12.3^{abc}	16.0^{bcd}	17.3^{abc}
	40	7.3^{a}	12.7^{ab}	14.0^{f}	16.3^{bc}
Organic fertilizer	1.0	7.0^{a}	11.0^{bcd}	15.0^{cdef}	16.0^{c}
Inorganic fertilizer	1.3	7.0^{a}	10.7^{cd}	16.0^{bcd}	17.0^{abc}
Control	0	7.3^{a}	12.7^{ab}	15.7^{bcde}	16.0^{c}

Means along the column with the same superscript(s) are not significantly different at 5% probability.

Table 5: Leaf area (cm^2) of maize treated with *A. lebbeck* aqueous extracts

		WEEKS AFTER PLANTING			
Treatments	**Ratio (%)**	**2**	**4**	**6**	**8**
A. Lebbeck leaf	10	97.8^{abc}	321.0^{d}	473.8^{b}	538.0^{b}
	20	102.3^{abc}	474.1^{ab}	588.0^{ab}	642.9^{ab}
	30	121.0^{ab}	397.5^{ab}	517.2^{ab}	567.3^{b}
	40	62.3^{c}	409.5^{ab}	540.4^{ab}	642.3^{ab}
A. Lebbeck Bark	10	70.1^{bc}	521.5^{a}	553.9^{ab}	665.0^{ab}
	20	96.3^{abc}	475.8^{ab}	578.1^{ab}	656.0^{ab}
	30	82.2^{bc}	416.3^{ab}	531.9^{ab}	652.0^{ab}
	40	92.3^{abc}	332.1^{b}	510.5^{ab}	600.0^{ab}
Organic fertilizer	1.0	65.0^{bc}	416.7^{ab}	522.7^{ab}	582.0^{ab}
Inorganic fertilizer	1.3	100.3^{abc}	412.0^{ab}	538.7^{ab}	599.8^{ab}
Control	0	111.7^{abc}	544.3^{a}	616.3^{ab}	590.0^{ab}

Means along the column with the same superscript(s) are not significantly different at 5% probability.

Table6: Stem girth (mm) of maize treated with *A. lebbeck* aqueous extracts

		Week After Planting			
Treatments	**Ratio (%)**	**2**	**4**	**6**	**8**
A Lebbeck leaf	10	10.3^{ab}	12.9^{ab}	14.9^{b}	16.1^{c}
	20	10.3^{ab}	15.7^{ab}	18.3^{ab}	19.1^{abc}
	30	5.7^{cd}	15.0^{ab}	16.4^{ab}	17.4^{bc}
	40	5.2^{d}	14.6^{ab}	16.9^{ab}	16.7^{bc}
A. Lebbeck Bark	10	9.9^{ab}	15.3^{ab}	16.5^{ab}	19.2^{bc}
	20	11.1^{a}	13.7^{ab}	17.2^{ab}	18.1^{bc}
	30	6.2^{cd}	13.3^{ab}	17.3^{ab}	17.8^{bc}
	40	6.0^{cd}	13.4^{ab}	16.3^{ab}	17.0^{bc}
Organic fertilizer	1.0	5.7^{cd}	13.7^{ab}	16.6^{ab}	17.1^{bc}
Inorganic fertilizer	1.3	7.7^{bcd}	15.7^{ab}	18.6^{ab}	19.3^{abc}
Control	0	6.4^{cd}	15.4^{ab}	17.6^{ab}	18.0^{bc}

Means along the column with the same superscript(s) are not significantly different at 5% probability.

Table 7: Effect of plant extracts on yield parameters

reatments	Ratio (%)	Fresh Weight(g)	Dry Weight(g)	Cob length (cm)	Seed weight per cob (g)	Weight of 100 grains (g)
. *Lebbeck* leaf	10	42.3^{ab}	19.0^{ab}	9.7^{a}	15.3^{abcd}	15.7^{ef}
	20	40.3^{ab}	16.0^{ab}	10.3^{a}	19.7^{abcd}	19.7^{cd}
	30	60.0^{ab}	25.3^{ab}	11.0^{a}	19.3^{abcd}	17.3^{cd}
	40	52.0^{ab}	27.7^{ab}	8.7^{a}	21.3^{abc}	18.3^{cde}
. *lebbeck* Bark	10	60.3^{ab}	31.3^{ab}	9.7^{a}	24.0^{ab}	23.3^{ab}
	20	38.3^{ab}	22.3^{ab}	9.0^{a}	25.0^{ab}	20.0^{bcd}
	30	47.7^{ab}	36.7^{a}	11.3^{a}	29.3^{a}	21.0^{bcd}
	40	34.0^{ab}	17.3^{ab}	8.0^{a}	12.7^{bcd}	13.7^{fg}
rganic fertilizer	1.0	30.0^{ab}	14.0^{ab}	8.0^{a}	23.3^{ab}	20.0^{cd}
ıorganic fertilizer	1.3	31.0^{ab}	8.0^{b}	8.5^{a}	20.0^{abcd}	18.3^{cde}
ontrol	0	23.0^{b}	8.0^{b}	7.0^{a}	14.0^{abcd}	13.7^{fg}


Appendix 1: Albizia lebbeck tree


Appendix 2: Albizia lebbeck leaves