PRINT ISSN 1119-8362
Electronic ISSN 1119-8362

Full-text Available Online at
https://www.ajol.info/index.php/jasem
https://www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage.
Vol. 26 (3) 429-437 March 2022

Effect of Intercropping Leguminous Tree Species on Soil Nutrient Status, Growth and Yield of Arable Crops in Ukan Edemaya, Ikot Abasi Local Government Area, Akwa Ibom State, Nigeria

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ABSTRACT: Intercropping improves the usage rate of a land while also maintaining soil fertility. This study is to examine the preliminary intercropping effect of leguminous trees species (*Leucaena leucocephala* (*Lam*), *Gliricidia sepium* (*Jacq*), and *Senna siamae* (*Lam*) on soil nutrient status, growth and yield of arable crops (*Zea mays L*) in two cropping seasons (2017 and 2018) using a field trial at Ukan Edemaya, Ikot Abasi Local Government Area of Akwa Ibom State, Nigeria. Treatments were randomized within the blocks and reproduced four (4) times on a 0.04 hectare plot of land that was cleared, demarcated into four blocks, and manually tilled. The study was a two-factor factorial using a Randomized Complete Block Design layout (RCBC). The data was analyzed using Analysis of Variance (ANOVA), and treatment means were separated using Least Significant Difference (LSD < 0.05). The findings revealed that all arable crop growth and production were not significant in weeks 1-6 (WAP), but significant from weeks 7 to 14 (WAP). Arable crops planted in *leucaena* alleys outperformed those planted in *Gliricidia* and *senna* alleys and outperformed those planted in plots without leguminous plants. Leguminous tree species were shown to boost the growth and yield of arable crops, as well as rehabilitate a damaged fertility soil quality, according to the study. Farmers are urged to intercrop their arable crops with leguminous tree species in order to increase yield and provide fuel wood.

DOI: https://dx.doi.org/10.4314/jasem.v26i3.9

Impact factor: http://sjifactor.com/passport.php?id=21082

Google Analytics: https://www.ajol.info/stats/bdf07303d34706088ffffbc8a92c9c1491b12470

Dates: Received: 10 January 2022; Revised: 22 February 2022; Accepted: 15 March 2022

Keywords: Field trial, Intercropping, Leguminous trees species, Yields, Arable crops.

Food shortages have plagued post-colonial Africa. Similarly, food production per capita has gradually grown. The continent's population rate of 3.1 percent per year dwarfs the increase in agricultural output per capita of 1.8 percent per year. In 1995, about 90% of Africa's population was rural-based subsistence farming households that relied only on fuel wood and charcoal for energy. Between 1981 and 1995, the pace of deforestation to suit their demands was estimated to be 1.3 million hectares per year. Between 1981 and 1995, the savannah woodland was predicted to have been destroyed at a pace of 2.3 million hectares per year. Food shortages and shrinking woods were exacerbated by the delicate environmental difficulties caused by a range of pests and diseases, in addition to the fragile environmental problems caused by a variety of pests and illnesses (FAO 2005). The Leguminosae family is the third largest flowering plant family, with 800 genera and 20,000 species (Lewis *et al.*, 2005). Indeed, legumes have an essential role (Voisin *et al.*, 2014) at the food system level, as a source of plant proteins for both human and animal consumption, and are becoming increasingly vital in enhancing human health. Tharanathan *et al.* (2003). Legumes have the potential to be competitive crops in terms of environmental and socioeconomic advantages, with the ability to be incorporated into current cropping systems marked by declining crop variety and excessive use of external inputs (i.e. fertilizers and agrochemicals) Plaza-Bonilla and colleagues (2016). The traditional system of farming (shifting cultivation) which relies on natural soil fertility can no longer meet

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the rapid increase in forest demand. Recently, more attention is being given to fertility maintenance and improvement of indigenous systems in which trees and shrubs which dominate the bush fallows have come into focus as effective soil fertility restorers (Wilson et al 2012). The stability of soil aggregates was improved due to the presence of living roots of leguminous trees and shrubs. Excellent results were achieved with legumes grown as green manure on light sandy soil; pruned materials form legumes trees species and stubles from field improved soil physical properties by supplying organic materials to the soil in form of green manure (Wojtowski, 2002). Woody perennial in Agroforestry and alley cropping in particular is however, the most important source of Nitrogen for agricultural crops. Legumes roots nodules system release significant amount of nitrogen after defoliation and plant pruning also fixed nitrogen exerted from nodules becomes available to maize. The climate of Agroforestry stands differs sometimes considerable from that pure sand. Difference in insulation temperature and relative humidity can lead to favourable or unfavourable growing conditions. (Wajja-Musukwe and Mbalule, 2001). Multi-storey stands of plants with varying grown structures make better use of available sunlight. This is especially true of home garden and at the same time, lack of sunlight can constitute a limiting factor for plant growth at the lower levels. Plant such as maize, millet and grasses respond mainly in a linear manner to the supply of light. The more light they receive, the better their performance, and in agroforestry, they still required the positions with the most sunlight in spite of the mixture nature of farming. Other plants are satisfied with less than full radiation intensity and are classed as "Shady tolerant" (Udofia 2007). To increase the availability of light in an agroforesty stand, it is crucial to choose suitable tress and arrange them effectively. Trees which open crowns that allow light through are particularly suitable. Broad and horizontal leaves produce deep shade, while small narrow slanting, pinnate leaves produce more light areas. *Gliricidia sepium* and *Leucaena leucocephala* species are therefore especially appropriate. The height of a tree crown from the ground also determines the amount of light area. The higher the crown the stronger is the lateral incoming light (Wajja-Musukwe and Mbalule, 2001). The shade cast from trees and shrubs alters the temperature at the soil surface and in the undergrowth. Excessive heat during the noon hours and too great heat loss during the night are avoided. Lower temperature induces higher relative humidity. The tress create a climate in which the transpiration pressure on crops falls, permitting more productive use of scarce water. If potential evapotranspiration exceeds the supply of water, plants close their stomata, cutting of the exchange gases. The longer this interruption last, the more severely photosynthesis is hindered. In open fields, photosynthesis is often suspended around noon due to heat and lack of water, whereas in agroforestry system food crops are on advantage. Agroforestry encompasses a set of land use practices which aim to realize the benefits from growing woody and herbaceous species together, commonly by the addition of trees to land already being used for pasture or for growing annual crops. It concerns the ways in which the presence of a plant can change the environment of its neigbours, generating a favourable balance between negative and positive plant interactions, and thereby increasing total yield, reducing yield variance and conserving resources. These ecological issues include a time dimension and as perceived by the farmer adopting agroforestry are considered from socio-economic and ecological perspective, regarding productivity, stability and sustainability in marginal land use systems (Pathak et al 2006). The objective of this study is to examine the preliminary intercropping effect of leguminous tree species (*Leucaena leucocephala* (Lam), *Gliricidia sepium* (Jacq), and *Senna siamae* (Lam) on soil nutrient status, growth and yield of arable crops (*Zea mays* L) in two cropping seasons (2017 and 2018) using a field trial was at Ukan Edemaya, Ikot Abasi Local Government Area of Akwa Ibom State, Nigeria.

MATERIALS AND METHODS

Site Location and Description: According to Udo (2008) Ukan Edemaya in Ikot Abasi Local Government Area lies within latitudes 4^{O} 53" and 4^{O} 88" North and longitudes 7^{o} 54" and 7^{o} 90" East. Ikot Abasi Local Government Area is located within South West corner of Akwa Ibom State sharing boundary with Mkpat Enin and Easterm Obolo Local Government Area in the East. Oruk Anam in the North and the Atlantic Ocean in the South. The Imo Rivers from the natural boundary in the West separating it from Rivers State (Figures 1 and 2). Rainfall begins in March and continues till October with the peaks in June and September. The dry seasons starts from November and extended to February, with temperature varying between 22^{O} – 32^{O}C and with relative humidity of 75% – 80%. Harmattan occurs in the months of December and January. The soils are deep, heavy sandy to sandy loam surface layer. The soil are generally acidic, due to oil spillage and acid rain and very low in basic caution nutrients such as Calcium, Mg N&P. the soil are formed on tertiary coastal plain sands, because of their sandy nature, they are fragile and highly susceptible to erosion. They are also acidic and generally referred to as "Acid Sands" since they are both acidic and sandy. (Peter, Udo Obot and Okon 1989).

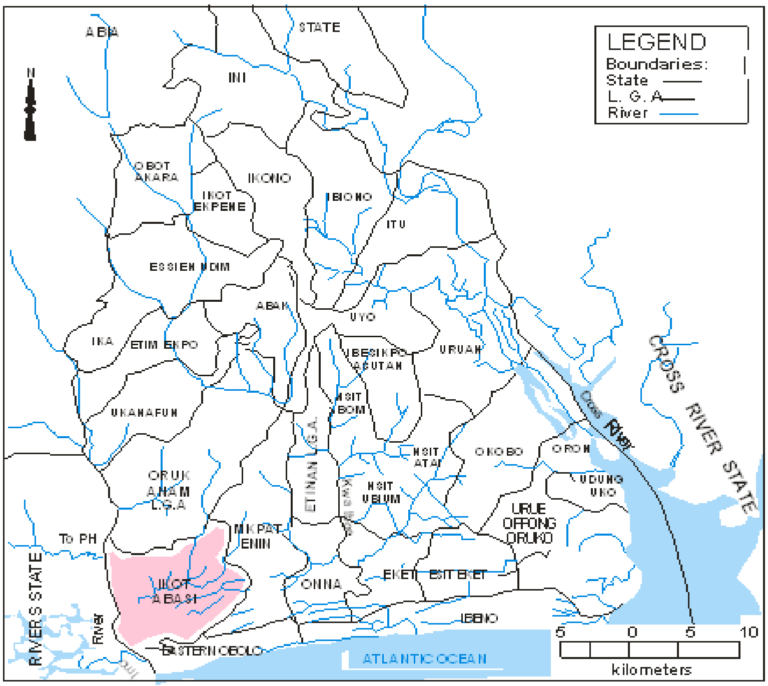

Fig 1: Akwa Ibom, State showing Ikot Abasi Local Government Area Adapted from Udoh (2008)

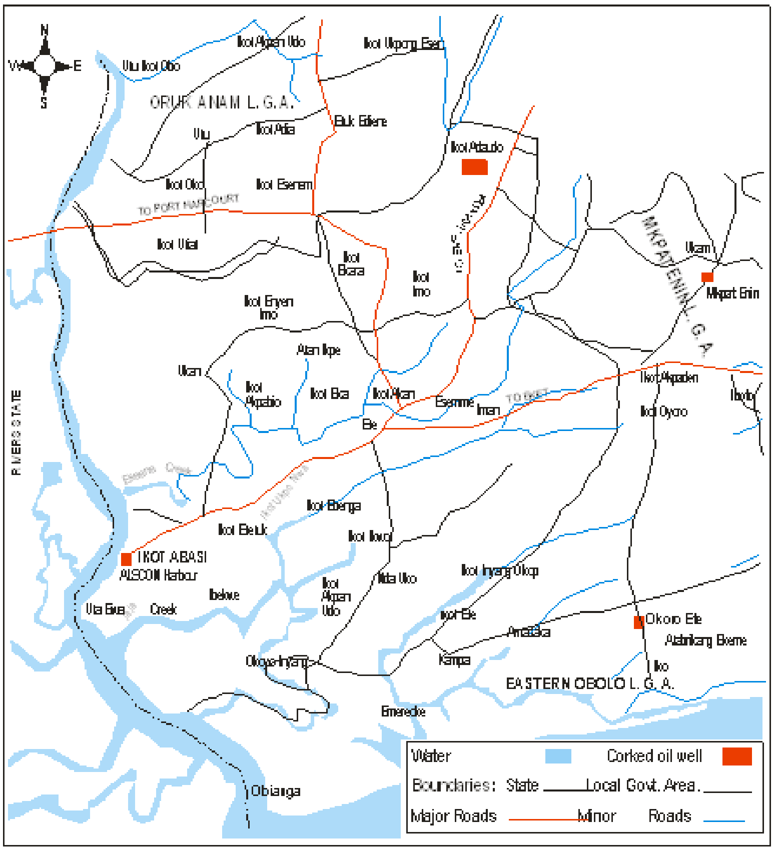

Fig 2: Ikot Abasi Local Government Area showing the study location: Ukan Edemaya Adapted from Udoh (2018)

The vegetation in the area is tropical rainforest. However, in most of the areas the original rain forest has virtually disappeared because of deforestation for farming, lumbering and infrastructural development.

Experimental Design and Field Layout: The Experimental area measured 19m x 22m, equivalent of 0.04 hectare was demarcated into four (4) blocks. There were two sets of factors which constituted the treatments. The first set of factors was leguminous tree species, *Leucaena leucocephala, Gliricidia sepium, Senna siamae* and control. The second sets of factors were food crops, *Zea mays, Lycopersicum esculentum* and *Abelmocus esculentus.* All the treatments were randomized within the blocks and replicated four (4) times. The food crops were randomized within the leguminous trees in the blocks in such a way that each replicate bore one species of leguminous tree and all the three food crops at a time. Thus each block was divided into four, this gave a total of 16 subplots as replicates. Each block measured 4m x 22m and with 2m gap separating each another so as to give enough room for boarded branching. The experiment was a straight 2 – factor factorial laid out in randomized complete block design (RCBC).

Soil Sampling and Analyses: Soil sampling was done before planting. Soil auger was used to collect soil samples from 0- 10cm, 10 – 20cm depths in 16 randomly selected parts in each block. The soil samples were put in the polythene bags and labeled according to plots. In the laboratory, the samples were spread and air dried on a table. They were sieved and replaced in the labeled polythene bags, the following methods were used in analyzing the soil samples.

(i) Soil pH: The soil pH was determined in 1:2:5 water suspension using pH meter (Bates 1995) method.
(ii) Organic Matter: The organic matter was determined by wet oxidation method of Walkley and Black (2014).
(iii) Total N: This was determined by Microjeldahl digestion and distillation method of Jackson (2014).
(iv) Available P: (Av.P) was determined by the method of Murphy and Riley (1962).
(v) Exchangeable Bases: Were extracted with neutral ammonium acetate solution. Potassium and Sodium in the extracts were determined by flame analyzer and Mg and Ca by EDTA titration method (Jackson 2014).
(vi) Particle size analysis was done by the hydrometer method of Bouyoucous (1951) using Sodium hexametaphosphate as the dispensing agent and after destroying high organic matter with H_2O_2, the texture was determined using textural triangle.

Soil filtration rate was determined using the core samples. 16 core samples were taken from 16 random selected points in one block, the core forced into the soil, and was removed when it was completely filled with soil. The bottom was tied to a piece of cloth to prevent the soil sample from dropping out.

Two liters of water were poured on top gently. With a stop watch and a tape to measure the core length, it was observed how long it took the water to drip out from the bottom of the core (Cm/Hr).

Experimental Materials: There were three leguminous tree species that had differentiating morphological characteristics and three food crops.
Leguminous tree species were:

(i) *Leucaena leucocephala* (Lam): This is a leguminous tree in the family of leguminosae. It attains reproductive phase as early as 4-6 months of age. At maturity it may attain a height of up to 5m. This multipurpose leguminous tree is modulating, fixes nitrogen with the association of rhizobium bacteria. The succulent leaves proved fodder and mulch, while the non-succulent aspects provide fuelwood.
(ii) *Gliricidia sepium* (Jacq): This tree species is in the family of papilonaceae. It is an average nodulating leguminous tree with height 6m and above at maturity.
(iii) *Senna siamae* (Lam): From the family of leguminosae, *caesalpiniodeae* grows to 20m. it is shrubby, evergreen and are propagated by direct seedlings and root suckers. Used as poles, timber, windbreak, reclaimation of denuded lands, as green manure and fodder.

Food Crops were:
(i) *Zea mays* – L: The variety was local flint maize (Ukai) the grains were bought from Ukan Edemaya market in Ikot Abasi Local Government Area.
(ii) *Lycopersium esculentum* – L: The seeds were bought from Akwa Ibom Agricultural Development Project (AKADEP) Uyo.
(iii) *Abelmoscus esculentus* – L: The seed were obtained from Akwa Ibom Agricultural Development Project (AKADEP) Uyo.

Statistical Analysis: Data on Height of crops, Food crop yield and Soil nutrient status were collected from each plot in the field and subjected to Analysis of Variance (ANOVA) in a straight 2 – factor factorial laid out in Randomized Complete Block Design (RCBC) and treatment means were separated with Least Significant Difference at 5% alpha level according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

Soil Nutrient Status before Planting and After Harvesting: The physical and chemical parameters (soil nutrient status) before planting and after planting are presented in table 1 and 2 respectively. The trends of soil nutrient values increased were indicated in table 2 from 6 month after planting through 9 month after planting. *Leucaena* blocks carried the highest soil nutrient values whereas the least value was in control blocks. The table showed that the soil nutrient contents improved in the blocks with leguminous tree species.

Height of Crops: Zea mays Height: Height of *Zea mays* as influenced by the leguminous tree species are shown in table 3. *Zea mays* interplanted with *leucaena* were the highest with mean height of (154.0cm) at 14 weeks after planting. *Gliricidia* and *Senna* height were 153.4cm and 153.0cm respectively. The control plots without hedgerow had the least height (152.9cm). Table 4 summarizes the analysis of Vanauce of the *Zea mays* height to be significant at P= 0.05 probability level.

The blocks with *Leucaena* were leading followed by *Gliricidia, Senna* respectively. The least were recorded in the control blocks. Table 5 shows the least significant difference means of *Zea mays* height under leguminous tree species. *Zea mays* interplanted with *leucaena* exceeded all other treatments in influencing the height *Zea mays* positively. There were followed by *Gliiricidia* and *Senna* blocks respectively.

Table 1: Soil Nutrition Status before Planting

	Soil Depth (cm)	pH	Org Ma% cm/kg	Total N%	AV.P Mg/kg	Ca	Mg	Na	k	Sand% cm/kg	Silk	Clay	Texture
Mean	0-10	4.31	2.01	0.07	60.32	1.84	0.87	0.03	0.04	83.32	8.03	8.04	SL
Mean	10-20	4.30	1.91	0.04	56.00	1.53	0.63	0.03	0.03	6.50	5.12	27.50	SL

SL = Sandy Soil; Org Ma = Original Matter, AV.P = Available phosphorus

Table 2: Effect of Leguminous Tree Species on Soil Nutrient Status after harvesting

Treatments	SoilDpt (cm)	pH	Org Ma% cm/kg	Total N%	AV.P Mg/kg	Ca	Mg	Na	k	Sand% cm/kg	Silk	Clay	Texture
Control	0-10	4.52	1.90	0.05	57.39	1.56	0.82	0.03	0.04	84.12	7.13	8.75	SL
	10-20	4.45	0.93	0.03	50.13	1.30	0.55	0.02	0.02	69.30	8.09	22.11	SL
Leucaena	0-10	4.12	3.25	0.18	89.69	2.35	1.23	0.06	0.11	73.16	14.54	12.30	SL
	10-20	4.10	2.11	0.08	71.99	1.22	1.10	0.05	0.05	52.13	21.66	26.21	SL
Gliricidia	0-10	4.20	3.10	0.12	82.54	2.18	1.02	0.05	0.08	71.12	18.65	10.32	SL
	10-20	4.17	3.99	0.05	66.49	1.45	0.35	0.04	0.05	61.13	13.58	25.29	SL
Senna	0-10	4.25	3.01	0.09	80.09	2.00	0.92	0.04	0.06	81.30	9.68	9.02	SL
	10-20	4.27	1.87	0.06	65.42	1.22	0.59	0.02	0.01	62.34	9.32	18.34	SL

SL = Sandy Soil; Org Ma = Original Matter; AV.P = Available phosphorus

Height of Abelmocus Esculentus: Table 6 shows the preliminary effect of leguminous tree species on *Abelmocus esculentus (cm)* in Ikot Abasi. The average height of *Abelmocus esculentus* with *leucaena* was the highest (64.50cm) followed by those of *Gliricidia* (64.0cm) and *Senna* (63.8cm). *Abelmacus esculentu* planted in the control plot had the least height (62.1cm). Table 7. Shows the analysis of variance of the effects of leguminous tree species on *Abelmacus esculentu* height. They were significant at 0.05 probability level among the four treatments. Table 8 summarizes the least significant difference means of all the four treatments. Statistical data showed that *Leucaena* was leading followed by *Gliriddia* and *senna* respectively, while control pot was the least. *Lycopersicum esculentum:* Table 9. Shows the effects of leguminous tree species interplanted with *lycopersicum esculentum.* In week 4 and 6 after planting, the *lycopersicum* interplanted with *leucaena* were leading with height of 12.3cm. *Gliriddia* 10.8cm, *Senna* 9.2cm respectively, while control blocks had the least with 8.1cm. In week 12, the height increased significantly. *Leucaena* blocks were leading in height for the experimental period.

Table 3: Block Effects of Leguminous Tree Species on Height (Cm) of *Zea Mays* in Ikot Abasi; Akwa Ibom

Treatments				
Time	Control	*Leucaena*	*Gliricidia*	*Senna*
2WAP	9.1	11.9	10.8	9.8
4WAP	3.5	37.1	36.5	35.2
6WAP	85.6	89.7	87.2	86.1
8WAP	115.5	118.4	117.2	115.8
10WAP	130.1	133.2	132.1	131.5
12WAP	151.8	152.8	152.4	152.1
14WAP	152.9	154.0	153.4	153.0

WAP = Weeks after Planting

Table 4: ANOVA of Effect of *Leguminous Tree* Species on the Height of *Zea mays*

Source of variation (SV)	Degree of Freedom (df)	Sum of Square (SS)	Mean of Square (MS)	F Ratio
Trt	3	23.69		23.43
Time	6	76324.34	1270.723	3812.24
Error	18	6.06	0.337	
Total	27	76354.09		

Significant at 0.5 probability level; LSD is 0.71

Table 5: Comparison of Means of Leguminous Tree Species of the Height of *Zea mays*

Treatments	Means
Control	97[a]
Leucaena	99[b]
Gliricidia	98.5[c]
Senna	97[d]

Subscript a, b, c, and d indicate significant difference means of the leguminous tree species on height of Zea mays.

Table 6: Block Effects of Leguminous Tree Species on *Abelmocus esculentus* Height (Cm) in Ikot Abasi.

Treatments				
Time	**Control**	***Leucaena***	***Gliricidia***	***Senna***
4WAP	5.0	5.8	5.6	5.5
6WAP	10.9	13.6	12.3	11.2
8WAP	29.3	33.1	32.8	30.9
10WAP	56.1	58.8	57.4	56.9
12WAP	62.1	64.5	63.8	62.8
14WAP	62.2	64.5	64.0	63.8

WAP = Weeks after Planting

Table 10, shows the statistical analysis of variance of the height of *lycopersicum.* The leguminous tree species shows significant position effect on the height of *lycopersicum* and also affect interaction significantly. Table 11, Shows the least significant different on all the treatments. The height of *lycopersicum* intercropped with *leucaena* attained the highest height than all other treatments, and were significant at 0.05 probability level.

Table 7: ANOVA of Effect of *Leguminous Tree* Species on *Alelmocus esculentus* Height

Sv	Df	SS	MS	F Ratio
Plots	3	19.77	6.59	21.68*
Time	5	13747.18	2749.44	9044.21*
Error	15	4.57	0.302	
Total	23	13771.52		

- *Significant at 0.05 probability level; LSD is 0.68*

Table 8: Comparison of Means Effects of Leguminous Tree Species on the Height of *Abelmocus esculentus*

Treatments	Means
Control	37.5[a]
Leucaena	40.0[b]
Gliricidia	39.3[c]
Senna	38.5[d]

Subscript a, b, c and d indicate significant difference between the mean of the leguminous tree species on Abelmocus esculentus height (cm)

Table 9: Block Effects of Leguminous Tree Species on Height (cm) of *Lycopersicum esculentus* Ikot Abasi.

Time	**Control**	***Leucaena***	***Gliricidia***	***Senna***
4WAP	5.0	6.0	5.8	5.6
6WAP	8.1	12.3	10.8	9.2
8WAP	20.1	25.2	23.3	21.5
10WAP	56.8	60.5	59.8	57.5
12WAP	57.0	65.0	60.5	50.0

WAP = Weeks after Planting

Table 10: ANOVA of Effect of *Leguminous* Tree Species on *Lycopersicu esculentus* Height

Sv	Df	SS	MS	F Ratio
Treatment	3	52.70	17.57	14.17*
Time	4	11178.84	17.57	2253.80*
Error	12	14861.24		
Total	19	121246.4		

Significant at 0.05 probability level, LSD = 1.4

Table 11: Comparison of Means Effects of Leguminous Tree Species on Height of *Lycoperiscum esculentus*

Treatments	Means
Control	29.4[a]
Leucaena	33.8[b]
Gliricidia	32.0[c]
Senna	30.8[d]

Subscript a, b, c and d indicate significant means of *lycopersicum esculentus* height

Food Crop Yield and Related Yield Characters: Zea mays Grain Yield and Related Yield Characters: Table 12 shows the effect of leguminous tree species interplanted with *zea mays. Zea mays* grain yield and related yield characters at 14 weeks after planting grown with *leucaena* gave the highest grain yield (2377kg) while *zea mays* grain yielded with *Gliricidia .and Senna* were 2118kg and 1852kg respectively. The least were *zea mays* grown in the control blocks 1705kg). Table 12 also indicates the number of days to 50% tasselling of *Zea mays. Zea mays* intercropped with *leucaena* tasseled earlier (55 days) followed by those with *Gliricidia* (58 days) and *Senna* (60 days) while the longest were *Zea mays* grown on the control plot (64days).

Table 12: Block Effects of Leguminous Tree Species on *Zea mays* Grain Yield and related yield characters in Ikot Abasi

Treatments	Grain yield (kg)	No. grain cob	Cob length	Days to 50% tasselling	No of leaves Plant (cm^2)
Control	-1705	224	10.2	64	10.4
Leucaena	-2377	367	20.8	55	15.6
Gliricidia	-2118	254	18.2	58	13.6
Senna	-1852	243	14.8	60	11.9

WAP = Weeks after Planting

Abelmocus esculentus Fruit and other Related Yield Characters: Table 13 Shows the effects of leguminous tree species on fruit yield and other related yield characters on *Abelmocus* revealed that *Abelmocus* were influenced by the leguminous tree species over the period which the experiment was conducted. *Abelmocus esculentus* intercropped with *leucaena* exceeded all other treatment including the control blocks. The numbers of fruits per stem of *Abelmocus* were the highest with *leucaena* (20), *Gliricidia* (18) and *Senna* (16) fruits respectively. The least fruit yield were that of the control with 14 fruits the number of leaves per plants were also influenced by leguminous tree species, the *leucaena* plot were leading (50 leaves), *Gliricidia* (45) and *Senna* (40) leaves respectively.

Table 13: Blocks Effects of Leguminous Tree Species on *Abelmocus esculentus* Fruit Yield and related Yield Characters Height

Treatments	No. of fruit yield	No. of leave $plant^{-1}$	Leaf area $plant^{-1}$(cm)
Control	14	28	2.7
Leucaena	20	50	8.2
Gliricidia	18	45	7.5
Senna	16	40	6.0

The controls were 38 leaves indicated that *Abelmocus* interplanted with leguminous tree species improved in growth and yields.

Lycopersicum esculentum Fruit yield and other Related Yield Characters: Table 14 shows the effect of leguminous tree species on the fruit yield and other related yield character, on *lycopersicum esculenlum.* The table revealed by the leguminous tree species over the period which the experiment was conducted. *Lycopersicum* intercropped with *leucaena* exceeded all other treatment including control. The number of fruit per stem of *Lycopersicum* were the highest with *leucaena* (20) *Gliricidia* (18) and *senna* (16) fruits respectively. The least fruit yield was that of the control with 14 fruits. The number of leaves per plants were also influenced by leguminous tree species, *Leucaena* plots were leading (129 leaves) *Giricidia* (116) and *senna* (109) respectively while the least were recorded in the control plot with 103 leaves, it indicated that *lycopersicum esculentum* interplanted with leguminous tree species improved in growths and yields.

Table 14: Block Effect of Leguminous tree species on *lycopersicum esculentum* Fruits yield and related yield characters in Ikot Abasi.
Height

Treatments	No. of fruit yield	No. of leave plant^{-1}	Leaf area plant^{-1}(cm)
Control	14	103	2.7
Leucaena	20	129	8.2
Gliricidia	18	116	7.5
Senna	16	109	6.0

According to the pre-planting soil analysis of the study area, the studied soil was found to be deficient in major plant nutrient elements, and the soil fertility evaluation criteria of Ibedu *et al.* (1988) and Landon's fertility rating; the studied soil is regarded as being low in these soil major nutrients. This might be due to the constant cultivation of the land with nutrient-dense arable crops, which have eaten up most of the major nutrients in the soil over time, resulting in a deficiency in important soil nutrients. Leguminous tree species have a substantial impact on the development and output of food crops. When compared to alternative treatments at the same age levels, the food crops under control had the lowest growth and yield values. Because there was no inorganic fertilizer or leguminous tree to restore the soil nutrients previously utilized by the food crops, the lowest results showed that the food crop depleted the soil. The fact that the soil nutrient status values in the control plots were likewise lower than the values in the other treatment with leguminous plants contributed to the poor crop values under the control. Hedgerow canopy diameters protect plots with legumes from direct sun exposure, as well as the amount of pruning as dry matter production, which helps to prevent water run-off and hence soil erosion. Intercropping grain legumes and cereals has the potential to increase the use efficiency of N sources, according to Wezel *et al.*, (2014), due to competing, complementary, or facilitative interactions. According to Etuk and Edem (2014), the Taunya system is a system in which agricultural and forestry crops may coexist in alleyways with forest trees capable of fixing nitrogen and other nutrients in the soil. In the leguminous plots, favorable meteorological circumstances and better soil nutrient status enhanced the development and output of food crops more than in the plots without hedgerows, according to Okigbo and Greenland (2006). Food crops may grow in a broad range of soil and climatic circumstances; nevertheless, in order to achieve food crops' optimum growth and production, the soil, among other things, must have enough nutrients, either through fertilizers or nitrogen-fixing tree species. The findings of this study support those of Grime, Hodgson, and Hunt (2014), who found that soil nutrient status increased in all plots with nitrogen-fixing tree species. It has been found that leguminous hedger trimming increases the growth and yields of a variety of food crops, owing to the nitrogen input. Leguminous tree prunings provide nitrogen and other soil nutrients, which enhance soil fertility and, as a result, boost food growth and production. Crop height increased more in legume-planted plots than in control plots, while leguminous tree pruning resulted in higher food crop height and yield than in plots lacking leguminous tree species (Grime, et. al., 2014). According to Okigbo and Greenland (2006), favorable climatic circumstances enhanced soil nutrient levels. Prunings from legume tree species contribute to soil organic matter and have shown promise in boosting the growth rate of food crops in agroforestry systems. Increased soil organic matter, improved soil porosity, recycling nutrients, improving soil structure, reducing soil pH, diversifying the microscopic life in the soil, and breaking disease and weed issues of grass-type crops are all benefits of legumes (Christopher and Lal 2007). Food crops impacted by leguminous prunings had a greater growth pattern in heights weeks after planting beneath a leguminous tree than control plots at the same age, according to this study. The results show that soil nutrient status was greater in plots with leguminous tree species than in plots without hedgerows.

Conclusion: The findings of this study demonstrate that all arable crops cultivated in leguminous tree combinations grew and yielded better than those planted in control plots. Soil nutrient conditions improve in blocks containing leguminous tree species.

While the control blocks had the lowest nutritional status readings, resulting in poor growth and production. Rather than growing arable crops on their own, leguminous tree species should be intercropped with arable crops for socioeconomic benefits. Agroforestry should be implemented on degraded farms and in areas where land is limited, particularly in tropical areas, to boost soil fertility. However, in an agroecosystem, growing nitrogen-fixing plants enhances and preserves soil fertility.

Acknowledgement: This research was funded by a TETFund Institution Based Research (IBR) Grant for Akwa Ibom State College of Education Afaha-Nsit during the 2016-2017 (Merged) TETFund Research Projects (RP) Intervention. Ref: TETFUND/DESS/COE/AFAHANSIT/2016/VOL.III

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