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Effect of Neem Residues and Weed Control Methods on Soil Properties, Weed Infestation, Growth and Yield of Egg Plant (*Solanum melongena* L.) in Kabba, Nigeria

Ogundare, S.K.[1]*, Hinmikaiye, A.S.[1], Oladitan, T.O.[2] and Agbona, A.I.[1]

[1]Department of Agronomy, Ahmadu Bello University, Zaria, Nigeria
[2]Department of Crop, Soil & Pest Management Technology, Rufus Giwa Polytechnic, Owo, Nigeria
*Corresponding author: drogundarekayode@yahoo.com

ABSTRACT

Soils of the Southern Guinea Savanna Zone of Nigeria are inherently low in soil nitrogen and organic matter and crop yields on these soils are low. Also, weed interference not only results in crop losses but also increases insect pest damage, harvesting difficulties and crop contamination. This study was carried out at the Teaching and Research Farm of the Agronomy Section, Kabba College of Agriculture in the year 2014, and repeated in the year 2015. The experiment was laid out in a 5 × 4 factorial experiment in Randomized Complete Block Design (RCBD). Neem residue were applied at the following rates; 0, 2.5, 5.0, 7.5 and 10 tons/ha. Weed control methods were (Atrazine (2.5 l/ha) at time of transplanting + Hoeing at 4 weeks after transplanting (AT+H4WAT), Atrazine (2.5 l/ha) at time of transplanting + Paraquat (200g/l) at 4 week after transplanting (AT+P4WAT), Glyphosate (3l/ha) at 2 weeks before plough + Atrazine at transplanting (G2WBP+AT) and No Weed Control (NWC). These gave 20 treatment combinations and were replicated thrice. Healthy and uniform eggplant seedlings were transplanted at 30 days after sowing. The seedlings were transplanted at the rate of one plant-per-hole at a spacing of 50 cm by 30 cm which make up 30 stands per plot of 6 m by 3 m (18 m^2). The growth parameters collected were plant height (cm), stem girth (cm), number of branches per plant and days to 50% at 1st flowering. Yield parameters collected were number of fruits per plant, individual fruit weight (g), fruit yield per plant (kg) and fruits yield per land area. Microbial population considered were fungi (sfu/g x 10^3), bacteria (cfu/g x 10^3) and, organic matter (g/g). Weed characters observed were weed species, weed dry weight and weed control efficiency (WCE). Analysis of variance (ANOVA) for RCBD was performed on the data collected. F-LSD was calculated at the probability levels of $P \leq 0.05$ to separate the means. From the findings of this work it can be concluded that eggplant do better with the application of 7.5 to 10 t ha^{-1} of neem residue, since, there was no significant difference in the growth and yield performance of eggplant with neem residue at 7.5 and 10 t ha^{-1}. The recommended rate for neem residue application in eggplant cultivation is therefore 7.5 ha^{-1} in the study area and related ecologies. All the weed control methods reduced weed infestations significantly, but glyphosate at two weeks before ploughing plus atrazine at time of transplanting recorded most weed control efficiency and thus suggested for the control of weeds in eggplant field in the study area and related ecologies.

Key words: Pepper, marketing, profitability, distribution channels, constraints

INTRODUCTION

Egg plant (*Solanum melongena* L.) is one of the most important vegetables that are consumed in Nigeria, after tomatoes, onions, pepper and okra (Akinfasoye et al., 2006). It belongs to the family Solanaceae (Pickersgill, 1971). Egg plants are short-lived perennials herbs, with a straight woody stem at the base and up to 1.5 meters in height (Tindall, 1992).

Yield of eggplant in Nigeria are generally low due to the use of varieties that are of narrow genetic base which are grown on soils that are of inherently low fertility (Dauda *et al.*, 2003). Eggplant improves human diet by adding flavour to meals. It is a cheap source of vitamins and minerals, promotes digestion and helps to prevent constipation (Aliyu *et al*., 1998). Eggplant responded positively to both mineral and organic fertilizers (Aliyu et al., 1998).

For optimum performance of crops, the nutrient contents of the soil should be adequate. The nutrient statuses of most tropical soils are low. Nigeria requires about fifty metric tonnes of inorganic or chemical fertilizer per annum (Dickson, 2004) for optimum crop production. The

resource - poor farmer prevalent in the country have little or no access to inorganic manure or chemical fertilizer due to high purchase cost. Organic fertilizer has been suggested to compliment inorganic fertilizer use and bridge the demand and supply for fertilizer (Adeniyan and Ojeniyi, 2005). Organic manure increases soil nutrient status and enhances the biological, chemical and physical properties of soils (FAO, 2005). It also increases the nutrient status of soils through gradual release of nutrients to the soil (Ibeawuchi *et al*., 2006) and supports crop performance and yield (Adebayo and Akoun, 2002). Weeds compete with crops for water, nutrients, space, light and oxygen (Hamma and Ibrahim, 2013). In agriculture weeds are very important because they lower yields (Akobundu, 1997). Yield losses may be as high as up to 100% under heavy infestation on some crops (Kolo and Daniya, 2006). Losses occur as a result of reduced yield, quality, harbouring of pests or diseases (Hamma and Ibrahim, 2013). Weeds serve as hosts for pests and diseases causing organisms. Removal of weed has been found to reduce the incidence pests (Gogoi, 1997). Some weeds have shown allelopathic effects on some crops (Okezie, 2000). Weeds interfere with farm operations like weeding and harvesting (Hamma and Ibrahim, 2013).Weeds has also been shown to block waterways, drainage pipes and make irrigation difficult especially during dry season farming.

Therefore, the objective of the study is to determine the effect of neem seed residue and weed control methods on soil properties, weed control efficiency, growth and yield of egg plant (*Solanum melongena* L.) in the study area.

MATERIALS AND METHODS

This study was carried out at the Teaching and Research Farm of the Agronomy Section, Kabba College of Agriculture in the year 2014, and repeated in the year 2015. The site is located on latitude 07° 35' N and longitude 06° 08' E and is 435 m above sea level, in Southern Guinea Savanna Agro Ecological Zone of Nigeria. Rainfall spans between April to November with peak in June. The dry season extends from December to March. The mean annual rainfall is 1570mm per annum with an annual temperature range of 18°C - 32°C. The mean relative humidity (RH) is 60% (College of Agriculture Meterological data, 2011). The major soil order within the experimental site is Ultisol (Babalola, 2010).

The experiment was laid out in a 5 × 4 factorial experiment in randomized complete block design (RCBD). Neem residue were applied at the following rates; 0, 2.5, 5.0, 7.5 and 10 tons/ha. Weed control methods were (Atrazine (2.5 l/ha) at time of transplanting + Hoeing at 4 weeks after transplanting (AT+H4WAT), Atrazine Atrazine(2.5 l/ha) at time of transplanting + Paraquat (200g/l) at 4 week after transplanting (AT+P4WAT), Glyphosate (3l/ha) at 2 weeks before plough + Atrazine at transplanting (G2WBP+AT) and No Weed Control (NWC). These gave 20 treatment combinations and were replicated thrice.

Egg plant seeds were sown in 15 cm row spacing on well prepared seed bed (1 x 10 m), covered with light soil and mulched with grasses until emergence. The beds were watered using watering can. The seedlings were thinned at 3 cm spacing within rows at first true leaf stage, followed by proper weeding and watering. Before transplanting, plots were ploughed and double harrowed. Neem residues were uniformly spread on the plots following the design and lightly worked into the soil with a hoe, one week to transplanting. Distance between blocks and plots were 1.0 m. Healthy and uniform seedlings were transplanted at 30 days after sowing (MoARD, 2009). The seedlings were transplanted at the rate of one plant per hole at a spacing of 50 cm by 30 cm which make up 30 stands per plot of 6 m by 3 m (18 m^2).

Soil sampling and processing: At the commencement of the experiment, a composite sample from ten random points was collected, using a soil auger at 0 - 15 cm depth for both years. Post planting soil samples were collected for each treatment and replication. The samples were air-dried, sieved through a 2 mm mesh and packed in paper bags for laboratory analysis.

Soil analysis

The soil samples collected were subjected to routine analyses at the Soil Laboratory of the Federal University of Technology, Akure, Nigeria. Particle size analysis was done by hydrometer method (Bouyoucos, 1962) while organic matter was determined by the procedure of Walkley and Black using the di -chromate wet oxidation method (Nelson and Sommers, 1982). Total N was determined by micro – Kjeldahl digestion method (Bremner, 1965) and available P was by Bray – 1 extraction followed by molybdenum blue colorimetry (Bray and Kurtz, 1945). Exchangeable K, Ca and Mg were extracted by EDTA titration method (Jackson, 1962). Soil pH was determined in 1:2 soil – water ratio using digital electronic pH meter.

Weed Characters

At 90 Days After Transplanting (DAT), weed samples were collected from two 50 cm × 50 cm randomly laid quadrants in each plot. The weeds were identified up to species level, cut at the soil surface, oven-dried at 80˚C for

48 hours and weighed to determine the dry matter (DM) yield. Weed Control Efficiency (WCE) was determined by the following formula

WCE =WDC – WDT X 100/WDC
Where
WDC= weed dry mass from the control plot
WDT= weed dry mass from the treated plots (Devasenapathy et al. 2008).

Statistical Analysis

Analysis of variance (ANOVA) for RCBD was performed on the data collected using the computer software Genstat, (Genstat, 2005). F-LSD was calculated at the probability levels of $P \leq 0.05$ to separate the means.

RESULTS

Table 1 shows the physicochemical properties of the soil before transplanting. The percentage (%) sand, silt and clay of the soil before application of amendments were 61.6, 18.0 and 20.4, respectively indicating the soil to be of sand clay loam with the pH of 6.14. The soils were low in nitrogen, phosphorus and other essential nutrients (Table 1). The chemical composition of neem seed residue used is shown in Table 2. The materials were relatively high in the essential nutrients required for the growth and development of crops.

The results of the effect of application of neem seed residue and weed control methods on soil chemical properties are presented in Table 3. The results show that application of neem residue did not significantly affect the soil pH in 2014 and 2015. However, there was reduction in soil pH in 2015 compared with 2014 except in control plots. Soil organic matter, N, available P, Ca and Mg were all significantly affected by neem amendments. Plots with neem residues had higher soil organic matter, nitrogen, available P, and Mg than control. Neem residue (10 t/ha) recorded the highest values of soil organic matter, N, P, in 2014 and SOM and P in 2015 cropping seasons. In 2014, control plots recorded the least value of soil organic matter, N, and P. Soil organic matter increased after 2 years of continuous cultivation irrespective of the rate of neem applied. Plots with 10t/ha neem residue had highest soil organic matter level (2.27%) while those treated with 2.5t/ha and un-amended plot (control) showed only slight increase in soil organic matter contents.

Significant difference was observed in available phosphorus due to different weed control methods. Plots treated with glyphosate two weeks before ploughing plus atrazine at the time transplanting recorded the highest value of available P in 2015, while the highest P value was obtained in control plots in 2014. Soil pH, SOM, N, Ca and Mg were not significantly affected by weed control methods imposed.

Growth characters of eggplant as influenced by application of neem residue and weed control methods are presented in Table 4. The results show that plant height, stem girth, numbers of branches per plant were affected significantly by neem residue application. The effects of neem residues on growth parameters were similar for 2014 and 2015 seasons. Plant height, stem girth, number of branches per plant was higher in plots treated with neem residues compared to control. Plots with 10t/ha had highest plant height and thickest plant in both years. However, this was not significantly better than plots treated with 7.5t/ha neem residues. Control plots recorded the shortest and thinnest plant throughout the experiment. Plots with 7.5t/ha neem residue had highest number of branches per plant in both years.

Table 1: Physical and chemical properties of soil of Kabba before the experiment

Properties	*2014*
Sand (%)	61.6
Clay (%)	20.4
Silt (%)	18
Soil texture class	Sand clay loam
pH 1:2 (soil/water)	6.14
Bulk density(g/cm^3)	1.46
Total porosity (%)	43.8
Organic matter (%)	1.83
Total N (%)	0.14
Available P (mg/kg)	3.16
Exchangeable K (cmol/kg)	0.34
Exchangeable Ca (cmol/kg)	1.68
Exchangeable Mg (cmol/kg)	1.43

Table 2: Chemical composition of neem seed used as soil amendment

Nutrients	(%)
Organic carbon	43.35
Total N	4.8
C:N ratio	9.03
phosphorus	1.08
Potassium	0.81
Calcium	1.19
Magnesium	0.24

Table 3: Chemical properties of soil as influenced by application of neem residue and weed control methods in Kabba

Treatment	Soil pH (H_2O)		SOM (%)		N (%)		P (mg/kg)		K (cmol/kg soil)		Ca (cmol/kg soil)		Mg (cmol/kg soil)	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Neem residue (NMR)														
0t/ha	6.2	6.2	2.6	2.5	0.11	0.13	1.7	2.1	0.39	0.41	3.4	3.1	1.3	1.4
2.5 t/ha	6.4	6.6	2.5	2.4	0.13	0.14	1.9	2.3	0.42	0.41	3.6	3.1	1.3	1.4
5t/ha	6.2	6.6	2.6	2.7	0.21	0.24	2.4	2.7	0.41	0.42	2.9	3	1.4	1.3
7.5t/ha	6.3	6.5	2.7	2.9	0.24	0.27	3.3	3.4	0.4	0.4	2.7	2.9	1.4	1.3
10t/ha	6.5	6.7	2.9	3.1	0.26	0.26	3.4	3.8	0.41	0.41	2.2	2.7	1.3	1.3
LSD	NS	NS	0.14	0.23	0.02	0.06	0.74	0.34	NS	NS	0.21	0.2	0.16	0.16
Weed Control Methods (WCM)														
AT+H4 WAT	6.2	6.1	2.5	2.6	0.2	0.2	2.1	2.6	0.44	0.44	2.2	2.6	1.3	1.4
AT+P4 WAT	6.3	6.3	2.6	2.4	0.2	0.2	2.5	2.3	0.44	0.41	2	3.1	1.3	1.3
G2WBT +AT	6.3	6.2	2.7	2.6	0.2	0.2	2.7	2.9	0.42	0.4	3.1	3.1	1.5	1.8
No Weed Control	6.3	6.2	2.9	2.7	0.2	0.2	2.8	2.4	0.41	0.43	3.1	3.4	1.4	1.3
LSD	NS	NS	NS	NS	NS	NS	0.21	0.23	NS	NS	0.56	0.27	NS	0.31
NMR vs WCM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

AT+H4WAT= Atrazine (2.5 l/ha) at time of transplanting + Hoeing at 4 week after transplanting, (AT+P4WAT)= Atrazine (2.5 l/ha) at time of transplanting + Paraquat (2.5l/ha) at 4 week after transplanting, G2WBP+AT= Glyphosate (3l/ha) at 2 week before plough + Atrazine at transplanting and NWC= No Weed Control.

Days to 50% at 1st flowering were earlier in plots treated with neem residue compared to the control plots irrespective of the rate of application. Among the treated plots, plots with 10 t/ha neem residues reached days to 50 % at 1st flowering earlier in 2014 while, plots with 5 t/ha neem residue reached days to 50 % at 1st flowering earlier in 2015.

Significant differences occurred in plant height, stem girth, numbers of branches as a result of weed control methods imposed. All plots with weed control methods were significantly better than control in plant height, stem girth and numbers of branches per plant (Table 4). Plots treated with glyphosate two weeks before ploughing plus atrazine at time of transplanting produced tallest and thickest plants. However, numbers of branches were better in plots treated with atrazine at ploughing plus hoeing at 4 weeks after transplanting. Number of days to 50% at flowering was not significantly affected by weed control methods.

Yield characters of eggplant as influenced by application of neem residue and weed control methods are presented in Table 5. Numbers of fruits per plant, individual fruit weight, fruits yield per plant and fruits yield per land area were significantly affected by neem residue applied. Plots with neem residue at rate of 10t/ha recorded greater value of numbers of fruits per plant, individual fruit weight, fruits yield per plant and fruit yield per land area. However, this was not significantly better than plots with neem at the rate of 5t/ha and 7.5t/ha in terms of yield parameters measured. Plots with neem residue application were better than the control. Table 5 also shows that weed control methods affect yield parameters of eggplant significantly. Plots with weed control methods were better in number of fruits per plant, individual fruit weight, fruits yield per plant and fruits yield per land area than control plots in both years.

Table 4: Growth characters of eggplant as influenced by application of neem residue and weed control methods

Treatment	Plant height (cm)		Stem girth (cm)		Number of branches per plant		Days to 50% at 1st flowering	
	2014	2015	2014	2015	2014	2015	2014	2015
Neem residue (NMR)								
0t/ha	29.3	30.4	0.72	1.06	13.6	12.9	58	59
2.5 t/ha	37.5	35.9	1.01	1.12	13.9	14.8	51	54
5t/ha	39.8	41.4	1.47	1.67	17.4	20.4	52	51
7.5t/ha	43.8	41.3	2.35	2.11	21.9	23.1	53	52
10t/ha	41.6	44.6	2.44	2.23	19.9	22.6	51	53
LSD	5.84	3.16	0.39	0.22	2.43	6.13	3.74	4.4
Weed Control Methods (WCM)								
AT+H4 WAT	43.6	48.1	1.68	1.56	23.1	24.3	54	52
AT+P4 WAT	42.7	44.8	1.54	1.78	22.2	21.4	52	53
G2WBT+AT	47.7	49.8	2.06	1.98	19.4	21.7	52	52
No Weed Control	26.8	31.6	0.93	0.86	16.4	14.8	54	54
LSD	8.66	7.4	0.22	0.56	5.11	4.82	NS	NS
NMR vs WCM	NS	NS	NS	NS	NS	NS	NS	NS

AT+H4WAT= Atrazine (2.5 l/ha) at time of transplanting + Hoeing at 4 week after transplanting, (AT+P4WAT)= Atrazine (2.5 l/ha) at time of transplanting + Paraquat (2.5l/ha) at 4 week after transplanting, G2WBP+AT= Glyphosate (3l/ha) at 2 week before plough + Atrazine at transplanting and NWC= No Weed Control

Table 5: Yield characters of eggplant as influenced by application of neem residue and weed control methods

Treatment	Number of fruits per plant		Individual fruit weight (g)		Fruit yield per plant (kg)		Fruit yield (t/ha)	
	2014	2015	2014	2015	2014	2015	2014	2015
Neem residue (NMR)								
0t/ha	11.6	13.9	47	38	0.55	0.53	5.5	5.3
2.5 t/ha	15.4	14.7	48	41	0.74	0.6	7.4	6
5t/ha	19.6	21.6	54	66	1.06	1.43	10.6	14.3
7.5t/ha	24.6	27.4	81	78	1.99	2.14	19.9	21.4
10t/ha	24.9	29.4	80	76	1.99	2.23	19.9	22.3
LSD	8.42	6.66	5.44	6.32	0.36	0.41	4.43	3.99
Weed Control Methods (WCM)								
AT+H4 WAT	26.1	24.7	74	66	1.93	1.63	19.3	16.3
AT+P4 WAT	28.3	26.1	69	77	1.95	2	19.5	20
G2WBT+AT	22.5	29.7	80	68	1.8	2.02	18	20.2
No Weed Control	9.2	11.4	34	44	0.31	0.5	3.1	5
LSD	6.87	5.85	17.66	12.61	0.34	0.46	6.44	7.83
NMR vs WCM	NS	NS	NS	NS	NS	NS	NS	NS

AT+H4WAT= Atrazine (2.5 l/ha) at time of transplanting + Hoeing at 4 week after transplanting, (AT+P4WAT)= Atrazine (2.5 l/ha) at time of transplanting + Paraquat (2.5l/ha) at 4 week after transplanting, G2WBP+AT= Glyphosate (3l/ha) at 2 week before plough + Atrazine at transplanting and NWC= No Weed Control.

Table 6: Microbial population as influenced by application of neem residue and weed control methods

Treatment	Fungi sfu/g x10^3		Bacteria cfu/gx10^3		Organic matter Cg/g)	
	2014	2015	2014	2015	2014	2015
Neem residue (NMR)						
0t/ha	197	131	281	245	1.54	1.52
2.5 t/ha	106	93	311	296	1.45	1.4
5t/ha	110	67	317	301	1.06	1.06
7.5t/ha	108	74	314	323	1.61	1.59
10t/ha	94	63	319	306	1.46	1.38
LSD						
Weed Control Methods (WCM)						
AT+H4 WAT	128	116	301	246	1.73	1.43
AT+P4 WAT	108	96	244	257	1.78	1.48
G2WBT +AT	103	61	213	254	1.96	1.23
No Weed Control	134	158	363	315	0.86	1.03
LSD	NS	36.4	43.1	33.8	0.42	0.21
NMR vs WCM	NS	NS	NS	NS	NS	NS

AT+H4WAT= Atrazine (2.5 l/ha) at time of transplanting + Hoeing at 4 week after transplanting, (AT+P4WAT)= Atrazine (2.5 l/ha) at time of transplanting + Paraquat (2.5l/ha) at 4 week after transplanting, G2WBP+AT= Glyphosate (3l/ha) at 2 week before plough + Atrazine at transplanting and NWC= No Weed Control.

Table 7: Weed characters of eggplant as influenced by application of neem residue and weed control methods

Treatment	Weed Species				Weed dry weight	
	2014	2015	2014	2015	2014	2015
Neem residue (NMR)	Broad leaves	Grasses	Broad leaves	Grasses		
0t/ha	4	13	5	13	463	644
2.5 t/ha	4	11	5	13	501	588
5t/ha	4	11	4	13	544	495
7.5t/ha	5	13	4	13	412	513
10t/ha	4	11	4	13	519	613
LSD	NS	NS	NS	NS	23.6	66.1
Weed Control Methods (WCM)						
AT+H4 WAT	1	8	4	7	264.3	312.6
AT+P4 WAT	1	6	5	8	271.3	274.9
G2WBT +AT	1	3	3	3	131.6	94.8
No Weed Control	5	14	8	15	1664.2	2117.8
LSD	1.55	3.46	2.61	4.63	98.6	116.7
NMR vs WCM	NS	NS	NS	NS	NS	NS

AT+H4WAT= Atrazine (2.5 l/ha) at time of transplanting + Hoeing at 4 week after transplanting, (AT+P4WAT)= Atrazine (2.5 l/ha) at time of transplanting + Paraquat (2.5l/ha) at 4 week after transplanting, G2WBP+AT= Glyphosate (3l/ha) at 2 week before plough + Atrazine at transplanting and NWC= No Weed Control.

However, plots treated with glyphosate 2 weeks before plough plus atrazine at transplanting recorded highest yield, but this was not significantly better than other plots with weed control methods (Table 5). Control plots recorded the least values of number of fruits per plant, individual fruit weight, fruit yield per plant and fruits yield per hectare.

Table 6 presents the result of microbial population as influenced by application of neem residue and weed control methods. Neem residues significantly affected fungal and bacterial populations in 2014 and 2015 seasons. Bacteria recorded higher population compared to fungi (Table 6). Near neutral pH levels of the soils could be responsible for the difference in their population. Plots with neem residues had significantly lower lower fungi population compared to control, while bacteria population were higher than control. Organic matter was lower in all the treated plots compared to control. Among the neem treated plots, plots treated with 10t/ha gave highest soil organic matter level. Weed control methods significantly affected microbial populations in 2014 and 2015 seasons. Plots with atrazine at time of transplanting plus hoeing 4 weeks after transplanting (AT+H4WAT) and plots with atrazine at time of transplanting plus paraquat at 4 weeks after transplanting (AT+P4WAT), had better fungi and bacteria population compared to plots with glyphosate 2 weeks before plough plus atrazine at transplanting (Table 6).

Table 7 presents the results of neem residue application and weed control methods on weed characters in an eggplant field. No significant differences in weed species occurred due to neem residue application. Weed control methods significantly affected both species and weed dry weight. Plots with weed control methods had lesser weed infestation relative to unweeded plots. Among the plots with weed control methods, plots treated with glyphosate at 2 weeks before plough plus atrazine at time of transplanting had highest weed control efficiency (92.09 and 95.52%) in 2014 and 2015, respectively (Table 8).

Table 8: Efficiency of the weed control methods used

Weed control methods	Weed Control Efficiency (%)	
	2014	2015
AT+H4WAT	84.12	85.24
AT+P4WAT	83.7	87.02
G2WBP+AT	92.09	95.52
NWC	0	0

AT+H4WAT= Atrazine (2.5 l/ha) at time of transplanting + Hoeing at 4 week after transplanting, (AT+P4WAT)= Atrazine (2.5 l/ha) at time of transplanting + Paraquat (2.5l/ha) at 4 week after transplanting, G2WBP+AT= Glyphosate (3l/ha) at 2 week before plough + Atrazine at transplanting and NWC= No Weed Control.

DISCUSSION

The nitrogen content of the soil was 0.14%, which is considerably low compared to the recommended critical level (1.5%) for Nigerian soils for most crops (Senjobi *et al*., 2013). The available phosphorus content of the soil was very low compared to the critical levels (10 - 12 mg/kg) and the exchangeable potassium content of the soil was also low compared to recommended critical level of 0.17 cmol/kg for Nigerian soils (Omotosho *et al*., 2008). The Ca, Mg and organic matter contents available in the soil were low and the soil pH indicates that the soil is slightly acidic.

The chemical composition of neem seed residue used was relatively high in the essential nutrients required for the growth and development of crops. Neem seed residue had low C/N ratio and high N content, which indicated that N mineralization could be easier. Soil organic matter, N, P, Ca and Mg and pH levels increased with the application of neem residue in treated plots compared to control. Ali *et al*. (2006) reported that soil chemical properties after two years of study improved in terms of soil pH, organic matter, total nitrogen and exchangeable cations in plots where organic residues were applied compared to un-amended control. Adeniyan and Ojeniyi (2005) indicated that application of poultry manure alone or in combination with reduced rates of NPK fertilizer, significantly improved soil chemical properties and nutrient uptake. Adenawoola and Adejoro (2005), Ano and Agwu (2005), Ayuba *et al*. (2005) also obtained similar results. Plant heights, stem girth, number of branches per plant were higher in plots treated with neem residues compared to control. The result is in line with the findings of (Gudugi, 2013). Smith and Ayenigbara (2001) observed top growth, weight and highest yield of Indian spinach with the application of organic residues (poultry waste). Plots with 7.5t/ha neem residue had highest number of branches per plant in both years. The observed result could be attributed to high rate of mineralization due to neem residue applied. Days to 50% at 1st flowering were earlier in plots treated with neem residue compared to the control plots irrespective of the rate of application. Matra et al. (1998) reported that organic residue (poultry manure) improved vegetative growth, flowering and fruiting of wheat but Kaltung *et al*. (1996) observed delay in flowering in okra due to application of organic residues. Plots with neem residue application were better than the control. This result agreed with the findings of Adeniyan, and Ojeniyi, (2003), who studied the growth, nutrient uptake and yield of tomato in response to organic wastes composites and found that dry matter content obtained with application of composite compared favourably with conventional NPK fertilizer and better than the control. Agele (2001) studied the growth and yield of tomato grown on degraded soil amended with organic wastes, and reported that poultry

litter resulted in higher root, shoots and fruits production than control plots. The findings in this experiment also corroborate the findings of Li and Mahler (1995), who obtained better vegetative and grains development in wheat, most especially when soil is amended with organic materials of low C: N ratio.

Bacteria recorded higher population compared to fungi; near neutral pH levels of the soils could be responsible for the difference in their population.

Plots with weed control methods were better in number of fruits per plant, individual fruit weight, fruits yield per plant and fruits yield per land area than control plots in both years. Phuong *et al*. (2005) opined that any reduction in weed pressure can be expected to promote yield as it lesson the strength of the competition for resources between crop and weeds. Control plots recorded the least values of number of fruits per plant, individual fruit weight, fruit yield per plant and fruits yield per hectare. (Akobundu, 1997) reported that weeds are very important because they lower yields. Organic matter was lower in all the treated plots compared to control. Among the neem treated plots, plots treated with 10t/ha gave highest soil organic matter level. The result is in line with the findings of Agele *et al.* (2015). Large quantity of neem residue coupled with high bacteria population that aid mineralization of residues may have been responsible for the observed results. Plots with weed control methods had lesser weed infestation relative to no weed plots and gave higher yield this could be attributed reduce competition with crops created when weed were controlled. Among the plots with weed control methods, plots treated with glyphosate at 2 weeks before plough plus atrazine at time of transplanting had highest weed control efficiency. This could be linking to longer residue effect of systemic herbicide (glyphosphate) when used. Systemic herbicides are used for weed control due to their longer residual action compared to contact herbicides.

CONCLUSION

From the findings of this work it can be concluded that eggplant can do better with the application of 7.5 to 10 t ha^{-1} of neem residue. Since, there no significant difference in the growth and yield performance eggplant with neem residue at 7.5 and 10 t ha-1 and thus suggested 7.5 ha-1 rate for the cultivation of eggplant in the study area and related ecologies. All the weed control methods reduced weed infestation significantly, but glyphosate two weeks before plough plus atrazine at time of transplanting recorded most weed control efficiency and thus suggested for the control of weeds in eggplant field in the study area and related ecologies. Further research should be carried out on the topic using different ecologies.

REFERENCES

Adebayo, O. and Akoun, J. (2002). Effect of organic manure and spacing on the yield and yield components of *Amaranthus cruentus*. In: Proceedings of 20th Annual conference of Horticultural Society of Nigeria held at National Horticultural Research Institute (NIHORT) Auditorium Ibadan, pp: 30-32.

Adenawoola, A.R. and Adejoro, S. A. (2005). Residual effects of poultry manure and NPK fertilizer residues on soil nutrient and performance of jute (*Corchorus olitorus* L.). *Nigerian Journal of Soil Science,* 15: 133 – 135.

Adeniyan, O. N. and Ojeniyi, S. O. (2003). Comparative effectiveness of different levels of poultry manure with NPK fertilizer on residual soil fertility, nutrient uptake and yield of maize. *Journal of Agricultural. Research.* 2: 191-197

Adeniyan, O.N. and Ojeniyi, S.O. (2005). Effect of study manure, NPK 15 15 15 and combination of their reduced levels on maize growth and soil chemical properties. *Nigerian Journal of Soil Science,* 15: 34 – 41.

Akinfasoye, I.A, Nmyan, D.J, and Tairu, R.M. (2006). Effect of harvesting frequency on the duration, yield and quality of Pepper. In; *proceeding of 24th conference of Hort. Society of Nigeria* 17-22 Sept. Gombe.

Akobundu, I.O., (1997). Weed Science in the Tropics. Principles and Practice, John Willy and Sons New York, pp: 522.

Ali E.T., Ogunsola, O.A., Ejekwolu, C.C., Adamu, J.U. and Abdulsalami, R.A. (2006). Effects of rates of poultry droppings on Irish potato production in Jos. Programme and Book of abstract of the 31st Annual Conference of Soil Science Society of Nigeria 13th – 17th November, 2006, Ahmadu Bello University, Zaria, Nigeria p. 43.

Aliyu, L., Hussaini, M.A. and Olarenwaju, J. D. (1998). Growth and dry matter yield of garden egg as affected by date of transplanting, intra - row spacing and nitrogen levels. *Nigerian Journal of Horticultural Science,* 3: 10 – 13.

Ano, A.O. and Agwu, J.A. (2005). Effect of animal manures on selected soil chemical properties. *Nigerian Journal of Soil Science*, 15: 14 – 19.

Ayuba, S.A., John, C. and Obasi, M.O. (2005). Effect of organic manure on soil chemicals properties and yield of ginger. *Nigerian Journal of Soil Science,* 15: 136 – 138.

Agele, S.O. (2001). Growth and yield of tomato grown on degraded soil amended with organic wastes. Proceedings of the 35th annual conference of Agricultural Society of Nigeria, Sept. 16-21, 2001,

University of Agric. Abeokuta, Nigeria. PP. 151-154.

Agele, S. O. Ojeniyi, S. O and Ogundare, S. K (2015). The Fluxes of Organic C and N, and Microbial Biomass and Maize Yield in an Organically Manured Ultisol of the Guinea Savanna Agroecological Zone of Nigeria. *Journal of Agricultural Chemistry and Environment*, 4: 83-95

Babalola, T.S. (2010) Land Evaluation Studies of Two Wetland Soil in Nigeria. An MSc Thesis Submitted to the Department of Crop, Soil and Environmental Sciences, Ekiti State University, Ado Ekiti, 141.

Bremner, J.M. (1965). Regular micro – Kjeldahl method for determination of total nitrogen. In Black, C.A. (eds), methods of soil analysis, part 2. American Society of Agronomy No. 9 Madison WI, pp 1149 – 1176.

Bray, R.H. and Kurtz, L. T. (1945). Determination of total and available forms of phosphorus in soils. *Soil Science,* 59,:39 – 45.

Bouyoucos, G.O. (1962). Hydrometer method improved for making particles size analysis of soils. *Agronomy Journal,* 54: 464 – 465.

Carter, M.R. (1993). Soil sampling and methods of analysis. Canadian Society of Soil Science, Lewis publisher London pp 823.

Devansenapathy P.T, Remesh, B. (2008). Efficiency indices for Agriculture Management Research. New Indian publishing Agency. New Delhi- India, pp. 57-64.

Dauda, N S., Aliyu, L. and Chiezey, U. F. (2003). Effect of variety, seedling age and poultry manure on growth and yield of garden egg (Solanum gilo L.). Proceedings of the 32nd conference of the Horticultural Society of Nigeria, School of Agriculture, Lagos State Polytechnic. pp 66 – 71.

Dickson, A. O (2004). Regional study of agricultural support, Nigeria's case special report prepared for food and agricultural organization

FAO (2005). FAOSTAT Database. http://apps.fao.org/default.htm. Accessed January 30, 2011

Gogoi, S., P.H. Gogoi, A. Mazunder and T.P. Saikua, 1997. Integrated method of weed control in a seed crop of okra. (*Abelmoschus esculentus*) *Annals of Agricultural Research*, 18(4): 432-436.

Gudugi, I. A. S (2003). Effect of cow dung and variety on the growth and yield of okra (*Abelmuschus esculentus* L.). *European Journal of Experiment* Biology, 3 (2): 495-498

Hamma and Ibrahim (2013). Weed Management Techniques of Horticultural Crops in Nigeria. *American-Eurasian Journal of Agriculture and Environmental. Science*, 13 (3): 362-366

Ibeawuchi, I.I., E.U. Onwerenmadu, N.N. Oti, (2006). Effect of poultry manure on green (Amaranthus cruentus) and water leaf (*Talinum triangulare*) on degraded ultisol of Owerri, South Eastern Nigeria. *Journal of Animal and Veterinary Advances*, 5(1): 53-56.

Jackson, M.L. (1962). Soil chemical Analysis. Practices – Hall Endewood Cliffs, New Jersey. Pp 491 -498.

Kaltung, M.D., Olarewaju J.D. and Gupta, U.S. (1996). Fruit and yield of okra as influence by farm yard manure and Nitrogen fertilizer. Proceedings of Horticultural Society of Nigeria conference Ago – Iwoye, 173 – 178.

Kolo, M.G.M. and E. Daniya, (2006). Effects of variety and methods of sowing on weed control and crop yield in sesame (Sesamum indicum L.) in southern guinea savannah of Nigeria. *Nigerian Journal of Agricultural Research*, 22: 22-31.

Li, G.C. and Mahler, R.L. (1995) Effect of plant material parameters on nitrogen mineralization in a mollisol. *Communication inSoil Science and Plant Analysis*. 26(11 – 12) 195 -198.

Maitra, S., Jana B.K. And Debnath, S. (1998) Response of plant nutrients on growth and alkaloid content of aswaganda (Withanig Somnifera Dunai) *Journal of Incrach Demicis* 24:242 – 246.

MoARD, 2009. Rural Capacity Building project. Course for Training of trainers on Improved Horticultural Crop Technologies. pp. 5-19.

Nelson, D.W. and Sommers, L.E. (1982). Total carbon, organic carbon and organic matter. In: page A.L, Miller R.H. and Keenay, D.R. (Eds) Methods of soil Analysis, part 2 ASA, Madison, WI, pp 539 – 580.

Okezie, A., 2000. Getting weed management technologies to farmers in Developing World. Abstract of III International Weed Science Congress USA, pp: 124-128.

Omotosho, S. O. and Shittu (2008). Soil properties, leaf nutrient composition and yield of okra (*Abelmoschus esculentus* (L.) Moench) as affected by broiler litter and NPK 15:15:15 fertilizers in Ekiti State, Nigeria. *International Journal of Agriculture Research,* 3:140-147.

Phuong, L.T., Denich, M., Vlek, P.L.G. and Balasubramanian, V. (2005). Suppressing weed in direct seeded lowland, rice effect of methods and seed rate of seedlings. *Journal of Agronomy and Crop Science*. 99(3): 185-194

Pickersgill B (1971). Relationship between wild and cultivated form of some species of chilli peppers (Genus Capsicum). *Evolution*. 25: 683-691.

Senjobi, B. A., Akinsete, S J., Ande, O T and Ademoye, O T. (2003). Sandy soil improvement using organic materials and mineral fertilizer on the yield and quality of jute plant (*Corchorus olitorius*). *Journal of Biology and Life Science*, 4(1):

Smith, M.A.K and Aiyenigbara, E. A (2001). Comparative growth and nutrient composition of

indian spinach in an enriched humid tropical environment. *Proceedings of African Crop Science Society Conference,* Uganda 5, 1007- 1013.

Tindall HD (1992). Commercial vegetable growing. Oxford University press London. Pp. 193

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