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Poultry Manure and Npk 15 15 15 Fertilizer and Their Residual Effect on Yield of White Yam (Dioscorea Rotundata) and on Soil Chemical Properties of the Forest Derived Savanna Zone of Edo State Nigeria

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ABSTRACT

The effects of poultry manure and NPK 15 15 15 fertilizer on the yield of white yam (Dioscorea rotundata) and the soil chemical properties were investigated in the field in 2012 and 2013 cropping seasons in Igueben, Edo State, Nigeria. It was a 4 X 3 factorial experiment arranged in a complete block design (RCBD) with three replicates. It consisted; 0,4,8 and 12 tons/ha levels of poultry manure and 0 100 and 200Kg/ha level of NPK 15 15 15 fertilizer. The poultry manure was applied 2 weeks before planting and the NPK fertilizer was applied during planting. Prior and after the experiment the chemical properties of the soil were determined. The nutrient content of the poultry manure was also determined. Yam tubers were harvested after 7 months of planting and determined for yield (tuber weight). Soil pH, Organic carbon, Nitrogen, Phosphorus, Calcium Magnesium Potassium and ECEC content of the soil were also determined. The result showed that poultry manure, NPK fertilizer and their combinations increased yield significantly at increasing level of application. However the optima yield was obtained at treatment combination of 12 tons pm/ha + 200Kg NPK/ha. The soil chemical properties were more significantly influenced by the treatment combinations than sole poultry manure and NPK 15 15 15 fertilizer. Consequently, the application of a combination of 12 tons pm/ha and 200 Kg NPK/ha had the greatest potential for yam yield and the sustainability of soil fertility in this research. It was therefore recommended for the cultivation of white yam in the forest derived savanna zone of Edo state, Nigeria.

INTRODUCTION

Inorganic fertilizer was advocated in the past years to ameliorate low inherent fertility of soils in the tropics. It is easier to ensure a balance adequate supply of nutrients by applying mineral fertilizer (Oladipo et al; 2009). Ofeniye et al, (2011) obtained increased value of soil organic matter, N, K, Ca and pH at Akure in Nigeria when 60Kg/ha NPK fertilizer was applied. However, the use of inorganic manure has not been very helpful in intensive agriculture because it is associated with soil acidity and nutrient imbalance among others. Ayeni (2010) stated that continuous use of sulphate of urea and ammonium nitrate contribute significantly to soil acidity. In wheat maize crop rotation by long term application of high nitrogen rate, soil responses became weakly acid; pH 5.5 (Despina et al; 2008) Depina et al, (2008) carried out analysis on the evolution of micro element content of soil (Boron, Zinc and Copper) and showed that in wheat-maize crop rotation, the probability of nutrient deficient seemed to be very high when only the mineral fertilizer was used. Applying high nitrogen rate increases soil acidity. Increased the Mn Content of soil; 162ppm Mn, causing toxicity. Olayinka (1990), stated that soil acidity, nutrient imbalance and soil physical degradation hinder sustainable use of inorganic fertilizer in the tropics. Consequently the use of organic manure in crop production is receiving renewed attention. Organic manure application sustains cropping system through better nutrient recycling and improvement of the soil physical attributes (El-Shakweer et al; 1998). However they are required in rather large quantities to meet up crop requirements (Nyth and Campbell, 1995,). Organic fertilizer can be quite variable from one batch to another, bulkiness, low nutrient content and late mineralization are

bottle neck to the sole use of organic manure for crop production (Elemon et al; 2000). To corroborate this view sudare (2004) stated that high sustained crop yield can be obtained with judicious and balanced NPK fertilizer management but non can solely supply all the nutrients and other conditions of growth for producing crops that can feed the teeming population (Uyobisere and Elemon, 2001). Some studies confirmed that combined application of organic and inorganic fertilizer gave superior effect in terms of balanced plant nutrient and improved soil fertility. (Ayeni et al; 2008).However the optimal rate of combining organic and inorganic fertilizer as well as optimal rate of application need to be investigated. Hence the objective of the study is to evaluate the effect of NPK, 15-15-15, poultry manure and their combinations on the yield of yam and soil chemical properties.

MATERIALS AND METHODS

Field experiment were conducted in 2012 and 2013 planting seasons at Igueben, Edo State Nigeria on latitude 6.601N and Longitude 6.241E in the forest derived savanna transition zone. The zone is characterized by two distinct conditions of wet and dry seasons. April-October is the wet season with a briefly lull in August and the dried is November-March. The soil is alfisol and had not received fertilizer treatment for 6yrs before the experiment.

Soil Sampling and Analysis

Soil sample (0-20cm) depth were collected randomly from the research site, bulked, dried, sieved and analyzed for physical and chemical properties. Particle size distribution was determined by the hydrometer method (Bouyoucos 1962). Soil pH was determined in soil/water suspension at 1:1 ratio using glass electrode pH meter (Bate 1954).

Total nitrogen was determined by using the micro kjeldah method (Bremner, 1965) and available P was extracted using Bray-1 solution and determined using molybdenum blue method (Frank et al; 1998). Organic manure was determined by the micro Kejdah digestion method (Nelson and Sommer, 1996). Exchangeable K, Ca and Mg were extracted using ammonium acetate, K was determined using a flame photometer and Ca and Mg by the EDTA titration method (Hendershot and Lalande 1993). Table 1

Table1. *Soil physical and chemical properties (0-15cm) depth of the experimental sites before planting and the chemical composition of poultry manure*

Soil Properties	Forest derived savanna Transition Soil	Poultry Manure
	2012	
Ph	6.00	7.75
Total N (g/kg)	0.92	2.5
Organic C (g/kg)	10.72	170.88
C/N	11.65	68.35
Available P(mg/kg)	5.19	0.33
Exchangeable Bases(cmol/kg)		
Ca	5.60	1.85
Mg	2.04	0.31
Na	2.83	0.149
K	0.47	0.52
Exch. Acidity (cmol/kg)		
H^+	0.20	-
Al^{+++}	0.0	-
ECEC (cmol/kg)	11.14	-
BS (g/kg)	98.20	-
Micro nutrient (mg/kg)		
Fe	86.74	17.02
Cu	34.68	10.0
Mn	0.80	5.913
Zn	17.17	15
Particle size (g/kg		
Sand	826	
Clay	39	
Silt	135	
Textural class	Loamy	

Bulk density (g/cm^3)	1.38	

The experiment was a 4x3 factorial which consisted of 4 levels of poultry manure, 0,4,8 and 12 ton/ha and 3 levels of NPK; O, 100 and 200kg/ha. These were replicated three times and fitted into randomized complete block design (RCBD) a spacing of 4m was allowed between blocks and 3m between replicate. Whole tubers (0.44Kg) with viable buds were each planted at a depth of 6cm/heap at spacing of 1m X 1m (Ogbedeh 2007).

There were 36 plots and 15 stands of yam per plot and 540 plants in the Site. Poultry manure was applied by broadcasting 2 weeks before planting and thoroughly worked with hoe into the soil to equilibrate with soil. The NPK was applied during planting. Yam vines were trailed on stake 3m high and weeding was done whenever necessary. The tubers were carefully harvested at 7months of planting and determined for yield (tuber weight). The weight was determined using a weighing balance. The yields in Kg/m2 were converted to tons per hectare. After the harvesting, the soil in the 36 plots were each randomly sampled and determined for chemical properties using the standard laboratory methods as previously done prior the experiment.

RESULT AND DISCUSSIONS

In 2012, significant effect on yam tuber weight was obtained from all levels of poultry manure (Table 2). The application of 12 tons PM/ha gave mean tuber weight of 46.57 tons/ha. While a mean weight of 31.87tons/ha was produced by the control. There was no significant difference between plots that received 4 tons PM/ha and 8 tons PM/ha with a mean yield of 37.20tons/ha and 41.13tons/ha respectively. However they differ significantly from plots that received 12 tones pm/ha. Sole application of NPK fertilizer increased weight significantly with increased level of application; 100 and 200Kg NPK/ha fertilizer application produced tuber weight that were significantly different in relation to the control. The highest weight of 32.73 tons/ha was obtained from 200Kg NPK/ha fertilizer compared to the control with a weight of 27.13 tons/ha. The combined application of 12 tons PM/ha + 200 Kg NPK/ha produced the highest yam tuber weight of 63.20 tons/ha in relation to the control with tuber weight of 15.20tons/ha. Consequently, among all treatments and their combinations, a combination of 12 tons PM/ha + 200Kg NPK/ha fertilizer performed better though some other combinations were also better than the control.

In 2013, the residual effect was also more effective among others due to 12 tons Pm/ha + 200 Kg NPK/ha. It gave yam tuber weight of 11.45 tons/ha in relation to the control with 5.27 tons/ha tuber weight. Residual effects of 12 tons PM/ha and 200 Kg NPK/ha were significant as they resulted in tuber weight of 8.25 tons/ha and 8.66 tons/ha relative to 6.36 tons/ha and 6.14 tons/ha in the control respectively, however, tuber weight recorded as a result of 4 tons PM/ha, 8tons PM/ha and 100 Kg NPK/ha were not significant when compared to the control.

Table2. *Effects of poultry manure and NPK fertilizer on yam tuber weight yield in forest-derived savanna transition zone soils*

2012
Tuber Weight tons/ha

Treatment (tons/ha) Poultry manure	Kg/ha NPK fertilizer			
	0	100	200	Means
0	15.20	33.70	46.70	31.87c
4	29.10	36.70	45.80	37.20b
8	30.20	38.00	55.20	41.13b
12	34.00	42.50	63.20	46.57a
Means	27.1c	37.73b	52.73a	

2013
Residual

Treatment (tons/ha) Poultry manure	Kg/ha NPK fertilizer			
	0	100	200	means
0	5.27	6.13	7.70	6.37b
4	6.17	6.37	7.50	6.68ab
8	6.60	7.67	8.00	7.42ab
12	6.50	6.80	11.45	8.25a
Means	6.14b	6.74b	8.66a	

DMRT =0.05. 4.86 (PM). 4.21 (NPK) 8.40 (NPK + PM) DMRT = 1.65 (PM). 1.43 (NPK) 2.87 (NPK + PM)

Means followed by the same letters are not significantly different at 5% level of probability.

All the treatments had no significant effects on soil pH in 2012 and 2013 (Table 3) However the highest soil pH of 6.34 was obtained from the combined effect of 12 tons PM/ha + 100 Kg

NPK/ha. The residual effect in 2013 had relatively lower pH than what was obtained in 2012. The highest pH; 6.10 was obtained from the residual effect of 4tons PM/ha + 200Kg NPK/ha. Soil organic carbon was increased significantly by both levels of NPK fertilizer from 15.62g/Kg in the control to 17.30g/Kg and 18.44g/Kg in 2012.

The highest organic carbon content of 19.04g/Kg and 19.94g/Kg were obtained from the application of 8 and 12 tons PM/ha respectively and were significant when compared to 12.57g/Kg in the control. The combination of 8 tons PM/ha + 0Kg NPK/ha and 12 tons PM/ha + 0Kg NPK/ha significantly resulted in the highest organic carbon of 20.05g/Kg and 21.22g/Kg relative to 6.00g/Kg in the control.

Residual effect of poultry manure significantly increased soil organic carbon from 8.81 g/kg in the control plot to the highest content of 12.10kg of 4tons PM/ha. Residual effect of NPK fertilizer though increased organic carbon slightly, the effect was not significant.

Table3. *Effects of poultry manure and NPK fertilizer on soil pH, organic carbon and total nitrogen in forest-derived savanna transition zone soils*

2012 Soil pH						**2013 Residual**				
Treatment (tons/ha) Poultry manure	**Kg/ha NPK fertilizer**					**Treatment (tons/ha) Poultry manure**	**Kg/ha NPK fertilizer**			
	0	**100**	**200**	**Means**			**0**	**100**	**200**	**Means**
0	5.73	6.20	5.54	5.82ns		0	5.69	6.00	5.46	5.71ns
4	5.87	5.83	6.30	6.00ns		4	5.84	5.80	6.10	5.91ns
8	5.72	5.56	5.93	5.74ns		8	5.60	5.66	5.89	5.71ns
12	5.69	6.34	5.85	5.96ns		12	5.65	5.60	5.87	5.70ns
Means	5.75ns	5.98ns	5.91ns			Means	5.70ns	5.77ns	5.83ns	
Organic carbon (g/kg)										
0	6.00	14.28	17.44	12.57c		0	6.59	10.34	9.53	8.81b
4	15.20	17.81	19.20	17.40b		4	12.88	11.99	11.44	12.10a
8	20.05	17.99	19.10	19.05a		8	11.68	10.44	12.88	11.67a
12	21.22	19.10	18.00	19.94a		12	11.76	11.50	11.78	11.34a
Means	15.62c	17.30b	18.44a			Means	10.73ns	10.82ns	11.41ns	

DMRT= 0.05. 1.10 (PM). 0.96 (NPK) 1.91 (NPK + PM) *DMRT= 0.05. 0.73 (PM) 2.56 (NPK +PM)*

Total nitrogen (g/kg)

0	0.75	2.00	2.32	1.69c		0	0.47	0.84	0.99	0.77b
4	2.48	2.30	2.49	2.42ab		4	0.91	0.89	0.85	0.88a
8	2.30	2.34	2.53	2.39b		8	0.84	0.95	0.97	0.92a
12	2.40	2.48	2.50	2.48a		12	0.94	1.02	0.89	0.95a
	1.98c	2.28b	2.46a				0.99ns	0.93ns	0.92ns	

DMRT= 0.05. 0.09 (PM) 0.08 (NPK) 0.10 (NPK + PM *DMRT = 0.10 (PM) 0.18 (NPK + PM)*

Means followed by the same letters are not significantly different at 5% level of probability

The highest nitrogen concentration of 2.53g/Kg and 2.50g/Kg were obtained from the combinations of 8 tons PM/ha + 200Kg NPK/ha and 12 tons PM/ha + 200Kg NPK fertilizer respectively in relation to 0.15g/Kg in the control. With sole treatment; application of 200Kg NPK /ha and 12 tons PM/ha significantly increased total nitrogen from 1.98 g/kg and 1.69g/Kg to 2.46g/Kg and 2.48g/kg respectively. Similar observation was obtained in 2013 except the effect of NPK fertilizer that was not significant and was below that of 2012. Available phosphorus was significantly increased in 2012 with the application of poultry manure and NPK fertilizer (Table 4). Fertilizer treatment had no significant effect on P in both years. The highest value of 13.12mg/Kg was obtained from a combination of 4 tons PM/ha+200kg NPK/ha fertilizer application. However lower available P concentration where

obtained in 2013. The highest residual value of 6.00mg was obtained from residual effect of 4tons pm/ha in relation to the control with P content of 5.30mg. Exchangeable Ca concentration in 2012 was not significantly influenced by all the treatment combinations in 2013 (Table 4)

Table4. *Effects of poultry manure and NPK fertilizer on soil available phosphorous, exchangeable calcium and magnesium in forest-derived savanna transition zone*

2012 Phosphorous						**2013 Residual**				
	Kg/ha NPK fertilizer						**Kg/ha NPK fertilizer**			
Treatment (tons/ha) Poultry manure	**0**	**100**	**200**			**Treatment (tons/ha) Poultry manure**	**0**	**100**	**200**	
0	9.24	11.00	9.56	9.94c		0	5.30	5.50	5.40	5.40c
4	11.90	12.86	13.12	12.63a		4	5.80	5.71	6.00	5.83a
8	11.45	11.00	12.58	11.68b		8	5.59	5.62	5.77	5.66b
12	12.48	12.58	11.36	12.14ab		12	5.72	5.58	5.75	5.68b
	11.26ns	11.86ns	11.66ns			Means	5.60ns	5.60ns	5.73ns	

DMRT= 0.05. 0.84 (PM) 1.46 (NPK + PM) *DMRT =0.05. 0.23 (PM) 0.39 (NPK + PM)*

Calcium (cmol/kg)

0	2.40	2.38	3.69	2.49ns		0	1.20	1.34	1.14	1.23b
4	2.76	3.00	2.99	2.92ns		4	1.85	2.40	2.10	2.11a
8	3.00	2.84	2.67	2.83ns		8	1.85	1.95	2.56	2.12a
12	2.88	2.42	2.85	2.72ns		12	2.10	1.55	2.56	2.07a
Means	2.76ns	2.66ns	2.80ns			Means	1.75b	1.81b	2.09a	

DMRT= 0.05. 0.30 (PM) 0.26 (NPK) 0.53 (NPK + PM)

Magnesium (cmol/kg)

0	0.95	1.10	1.43	1.16b		0	0.81	0.60	1.09	0.83b
4	1.43	1.50	1.43	1.45a		4	0.98	1.08	1.09	1.05a
8	1.42	1.47	1.50	1.46a		8	0.97	1.00	1.25	1.07a
12	1.45	1.45	1.48	1.46a		12	1.07	0.78	1.25	1.03a
Means	1.31b	1.38ab	1.46a			Means	0.95b	0.86c	1.17a	

DMRT= 0.05. 0.14 (PM) 0.12 (NPK) *DMRT= 0.05. 0.09 (PM) 0.80 (NPK) 0.66 (NPK + PM)*

Means followed by the same letters are not significantly different at 5% level of probability

however the highest value of 300 cmol/Kg was obtained from 4 tons Pm/ha + 100 Kg NPK/ha and 8tons PM/ha + 0kg NPK/ha fertilizer compared to the control with Ca content of 2.56 cmol/kg which was obtained from the residual effects of 8 and 12 tons PM/ha + 200Kg NPK/ha in relation to the control with a content 1.20 cmol/Kg. The highest exchangeable Mg concentration of 1.50 cmol/Kg was obtained from combined application of 4 tons PM/ha + 100 Kg NPK/ha and 8 tons PM/ha + 200 Kg NPK/ha in relation to the control with content of 0.95 cmol/Kg.

which was obtained from residual effect of 8 tons PM/ha + 200Kg NPK/ha and 12 tons PM/ha + 200Kg NPK/ ha in relation to the control with content of 0.81 cmol/Kg. Exchangeable Na concentration was only significantly increased by combination of poultry manure + NPK fertilizer in 2012 (Table 5) the Highest value of 0.57 cmol/Kg was obtained from a combination of 12 tons PM/ha + 200Kg. NPK/ha fertilizer level.

The residual effects of 12 tons PM/ha + 200Kg NPK/ha, 0tons PM/ha + 100Kg NPK/ha and 8 tons PM/Ha + 200 Kg NPK/ha treatment also had significant effect on soil sodium content. Sole NPK and poultry manure and their residual effect had no significant effect on Na content of the soil. And the soil exchangeable with the treatment Sole NPK and poultry manure and their residual effect had no significant effect on

Na content of the soil and the soil exchangeable with the treatment.

All the treatments had no significant effects on exchangeable K concentration in 2012. Exchangeable K concentration was significantly increased by all the residual treatment in 2013. The highest exchangeable K concentration; 0.18 cmol/Kg was obtained from the residual combination of 12 tons Pm/ha and 200kg NPK/ha fertilizer relatively to 0.04 cmol /Kg in the control.

Table5. *Effects of poultry manure and NPK fertilizer on exchangeable sodium, potassium and ECEC in forest-derived savanna transition zone soils*

2012 Sodium (Na) (cmol/kg)						**2013 Residual**				
Treatment (tons/ha) Poultry manure	**Kg/ha NPK fertilizer**					**Treatment (tons/ha) Poultry manure**	**Kg/ha NPK fertilizer**			
	0	**100**	**200**	**Means**			**0**	**100**	**200**	**Means**
0	0.27	0.31	0.23	0.27ns		0	0.20	0.26	0.24	0.23ns
4	0.26	0.26	0.26	0.26ns		4	0.24	0.24	0.24	0.24ns
8	0.29	0.24	0.25	0.27ns		8	0.24	0.20	0.25	0.23ns
12	0.34	0.25	0.57	0.39ns		12	0.26	0.23	0.25	0.24ns
	0.25ns	0.27ns	0.33ns				0.24ns	0.23ns	0.25ns	

DMRT = 0.22 (NPK + PM) *DMRT = 0.04 (NPK + PM)*

Potassium (K) (cmol/kg)

0	0.07	0.10	0.13	0.10ns		0	0.04	0.06	0.07	0.06c
4	0.10	0.09	0.11	0.10ns		4	0.07	0.06	0.07	0.07c
8	0.11	0.16	0.12	0.13ns		8	0.07	0.14	0.09	0.10b
12	0.18	0.12	0.12	0.14ns		12	0.16	0.10	0.18	0.15a
	0.12ns	0.12ns	0.12ns				0.08b	0.09ab	0.10a	

DMRT = 0.02 (PM). 0.01 (NPK) 0.03 (NPK + PM)

ECEC (cmol/kg)

0	3.85	4.22	5.21	4.43b		0	2.47	2.58	2.81	2.62b
4	4.80	5.05	4.90	4.92ab		4	3.41	3.7	3.81	3.64a
8	5.12	4.91	5.08	5.04a		8	3.44	3.5	4.45	3.80a
12	5.09	4.64	4.83	4.85ab		12	3.84	2.88	4.46	3.73a
	4.72ns	4.71ns	5.01ns				3.29b	3.17b	3.88a	

DMRT= 0.50 (PM). 0.87 (NPK + PM) *DMRT= 0.60 (PM). 0.52 (NPK) 1.04 (NPK + PM)*

Means followed by the same letters are not significantly different at 5% level of probability

ECEC was significantly increased by poultry manure; the highest content of 5.04 cmol/Kg was obtained from 8tons Pm/ha in relation to 4.43 cmol/Kg obtained from the control (Table 5). Sole application of NPK fertilizer had no significant effect in ECEC content in transitional soil. The combined effects of poultry manure and NPK fertilizer in 2012 increase ECEC significantly; the highest content of 5.21 cmol/kg was obtain at the combination of 0 tons pm/ha + 200kg NPK/ha fertilizer level in relation to 3.85 cmol/kg in the control, residual effects of poultry manure, NPK fertilizer and their combinations significantly increased ECEC. The highest responses of 4.46 cmol/kg was obtained from the residual effect of 12ton pm/ha +200kg NPK/ha in comparism to 2.47 cmol/kg in the control. Observation revealed that a combination of poultry manure and NPK fertilizer was more effective with the tuber yield of 63.20 tons/ha obtained at a combination of 12tonpm/ha + 200kg NPK/ha than the values obtained from sole poultry manure and NPK fertilizer treatments. Combined NPK and poultry manure application had the benefit of combining nutrients from organic and inorganic sources. The nutrients were retained by organic and soil colloids and gradually released for plant use during the vegetative and reproductive needs of yam. Ayoola and adeniyan (2006) reported that nutrients from mineral fertilizer enhanced yield. Sole poultry manure may not had been adequately mineralized why sole NPK fertilizer

may have been used as luxury uptake and hastily leached off the soil and consequently gave relatively lower yield (People, 1995). Application of sole PM and sole NPK fertilizer did not significantly influence soil pH in both years. However, the combination of 12tons Pm/ha +100kg NPK/ha significantly increased soil pH. In 2013 residual poultry manure did not significantly increase soil pH but residual NPK fertilizer as well as their combinations in increased soil pH significantly. This agrees with the findings of Adeniyan *et al, (*2011) who reported that organic manure had grater potential for raising soil pH compared to NPK fertilizer. Ojemyi *et al;* 2011) asserted that increased in soil pH could be due to the supply of basic nutrients (K,Ca and Mg). in contrast, nutrients released by NPK were retained for short period because of leaching hence low soil pH was obtained.

Increased in soil organic carbon could have resulted from the intimate incorporation of organic manure into the Soil. Ademola and Adejoro (2005) revealed that organic matter and soil nutrient increased with increased application of poultry manure.

The concentration of total nitrogen in 2012 was increased significantly by poultry manure, NPK fertilizer and their combinations as well as their residual effects in relation to the control. However, low response was obtained with the sole application of NPK fertilizer. This could be due to the fact that nutrient supplied by NPK fertilizer lasted for a short time because of leaching and luxury uptake by plants.

Available P concentration was influenced significantly by the application of poultry manure and poultry manure + NPK fertilizer in relation to the control plot in 2012 and 2013. However sole NPK fertilizer had no significant effect in 2012. Available P concentration in poultry manure treated plots were higher compared to sole effects of NPK fertilizer and the control. The high concentration observed with the application of poultry manure and its combination with NPK fertilizer could be due to high P content of the applied poultry manure. However the low P concentration in the residual plots was probably due to unfavorable soil pH which was below6.00. Maximum phosphate availability to plant is obtained when soil pH is maintained at a range of 6-7 (Brady 1999).

The high content of Ca, Mg and K obtained in 2012 and 2013 was probably a reflection of high organic matter with high rate of mineralization. The plot treated with poultry manure and its combination with NPK fertilizer had high ECEC in relation to the control and sole NPK fertilizer treated soil. Therefore treated soil were expected to be more productive because of low Al+3 and H+ ions in the soil. High ECEC is an indication of high nutrient storage capacity of the soil (Biswas and Mukherjeee, 2006).

CONCLUSION

Poultry manure, NPK fertilizer and their combinations significantly increased yield of yam tubers (weight) at increasing level of application. However the optima yield was obtained at 12 tons pm/ha + 200kgNPK/ha. The soil chemical properties were more significantly influenced by the treatment combinations than sole poultry manure and sole NPK fertilizer application, consequently the application of a combination of 12 tonspm/ha and 200kg NPK/ha had the greatest potential for yam yield and the sustainability of soil fertility in this research it is therefore recommended for cultivation of yam in the forest derived savanna zone of Edo State.

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