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Effects of Poultry Manure on Green (*Amarathus cruentus*) andWaterleaf (*Talinum trinagulare*) on Degraded Ultisol of Owerri Southeastern Nigeria

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Abstract: The number of leaves per plant increased with increase in poultry manure rate. Applications up poultry manure at all rates in the entire plots generated high weed yield that the control plots were significantly lower ($p \geq 0.05$) than plots with poultry manure. Weeds were suppressed because the control plots were degraded and had low soil fertility. After the experiments, the plots with poultry manure were more fertile than the control plots. Thus, there were increases in soil N (0.84%), organic matter (3.93%) P (13.45ppm), while the exchangeable cations K (0.76), Ca (0.71) and Mg (0.63) Cmol (+) kg^{-1}, respectively. The high organic matter percentage, with increase in the other soil chemical components, it is an indication that poultry manure has high potential of gradual nutrient release to the soil that can help to improve the fertility of a degraded soil; thereby sustaining yield under-continuous cropping system.

Key words: Poultry manure, degraded ultisol, intercropped green/waterleaf, owerri southeastern Nigeria

INTRODUCTION

Many crop species respond well to the application of organic manure and it can sustain yield under continuous cropping on most soils unlike equivalent amount of NPK fertilizers[1]. The potentials of organic matter and nutrient supply of the soil is particularly important in our today's agriculture especially in our tropical environment where chemical fertilizers are no longer as readily available and economically feasible[2].

The general objective of the experiment was to investigate the effect of poultry manure and its responsiveness on degraded ultisol of Owerri Southeastern Nigeria.

MATERIALS AND METHOD

The study was conducted at the experimental farm of the Federal University of Technology, Owerri on latitude 5°27'N and longitude 7°02'E on an elevation of 91.0m., located in the heart of the rainforest region of Southeastern Nigeria. It has the following climatic characteristic 1,953 mm annual rainfall, mean annual temperature and relative humidity of 28°C and 88% respectively.

The soils derived from coastal plain acid sand and have rainforest vegetation. The soils southeastern Nigeria have been developed from deep unconsolidated marine sediments of Pleistocene age often known as coastal plain acid sands[3]. The soils formed from these acid sands are classified as ultisols and they cover about 70% of the total land surface[4,5]. These ultisols are characterized by low nutrient reserve and high subsoil acidity as well as other chemical constraints[6,7]. However, the ultisols of Owerri agro ecological zone are known to support the dense population of Owerri reaching up to 500 people per kilometer[8].

Soil particle analysis (0-20cm) of the plough layer (-20cm) revealed that it had 91% said, 6.8% clay and 2.2% silt fraction. The preplanting soil chemical analysis showed that it had 1.22% Organic matter 0.06% N, 10.53ppm p(Bray 11), exchangeable basis magnesium, calcium and potassium of 0.40, 0.61 and 0.30 Cmol kg^{-1}. The$_p$11 was 4.45 (Table 1).

Poultry manure analysis: The poultry manure was analysis in the SAAT laboratory FUTO and the proximate nutrient composition of the manure was 10.78% Nitrogen, 2.04% Organic matter^{-1} 12.05ppm **P**(Bray II), and exchangeable bases Mg, Ca and K of 1.21, 2.22 and 1.54 Cmol (+) kg^{-1} and the pH was 7.42. The poultry manure was weighed out at the rate of 0.2500, 5000, 7500 and 10,000kg ha^{-1}. The experimental design was a split plot in a Randomized Complete Block Design (RCBD) with 3 replications. Each main plot measured 10x1m, which was split into 3 to make the subplots. Each subplot measured 3x1m with 0.5m spacing between each subplot and each main plot. There was a total of 45 plots made up of 5 main plots and 3 subplots in the 3 replications (Table 2 and 3).

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Table 1: Poultry Rates and Ferti8lity Status Before and After The Experiment

Initial Soil Status Before The Experiment

%OM	%N	P(ppm) Bray 2	Exchangeable cations Cmol(+)kg^{-1}			P^{H} (water)
1.22	0.06	10.53	0.30	0.60	0.40	4.60

After experiment

Poultry manure rates Kgha^{-1}	0	2,500	5,000	7,500	10,000
Sole Green Exch cation Cmol (+) kg^{-1}					
%OM	0.69^{c}	1.99^{b}	2.33^{b}	3.08^{a}	3.93^{a}
%N	0.05^{c}	0.14^{b}	0.24^{b}	0.79^{a}	0.84^{a}
P(ppm)	10.51^{c}	12.28^{b}	12.88^{ab}	13.04^{a}	13.45^{a}
K	0.28	0.70^{a}	0.75^{a}	0.75^{a}	0.75^{a}
Ca	0.55^{c}	0.62^{b}	0.70^{a}	0.71^{a}	0.71^{a}
Mg	0.34^{c}	0.44^{b}	0.59a	0.61a	0.63a
pH	4.59a	4.61a	4.61a	4.61a	4.61a
Sole Water leaf Exch cation Cmol (+) kg^{-1}					
%OM	0.68c	1.98b	2.31b	3.11b	3.08a
%N	0.05c	0.11c	0.26b	0.69a	0.74a
P(ppM)	0.20e	12.18c	12.74a	13.13a	13.40a
K	0.37c	0.67b	0.76a	0.76a	0.76a
Ca	0.45c	0.66b	0.68a	0.68a	0.71a
Mg	0.32a	0.45b	0.56a	0.60a	0.61a
pH	4.59a	4.60a	4.61a	4.61a	4.61a
Intercropped Green Waterleaf Exch cation Cmol (+) kg^{-1}					
%OM	0.54c	1.87b	2.22b	3.04a	3.07a
%N	0.05c	0.10c	0.25b	0.58a	0.70a
P(ppM)	9.48e	12.21b	12.99a	13.10a	13.18a
K	0.24c	0.67b	0.69a	0.75a	0.74a
Ca	0.40c	0.69a	0.70a	0.70a	0.71a
Mg	0.30a	0.48b	0.54b	0.64a	0.68a
pH	4.59a	4.60a	4.60a	4.61a	4.61a

Means followed by different letter(s) within a column differ at P=0.05 Dincan's Multiple Range test

Table 2: Number of leaves per plant 6 weeks after transplanting (WATp)

Poultry Manure Rates Kgha^{-1}	Sole Green	Sole Waterleaf	Intercropped Green	Intercropped Waterleaf
0	41	50	42	49
2500	47	52	61	55
5000	79	84	84	86
7500	104	102	108	123
10.000	107	107	104	126
.LSD 90.05) Cropping system	NS			
Poultry Manure	2.42			

Table 3: Mean Weed Fresh Weight in Kg/ha^{-1} at 2, 4 and 6 waterp

Cropping System	Poultry Manure Rates (kgha^{-1})	Weeks After Transplanting 2	4	6
Sole Green	0	1400^{c}	1200^{b}	950^{b}
	2500	1710^{b}	1688^{c}	056^{c}
	5000	2040^{b}	1850^{b}	222^{b}
	7500	3980^{a}	3650^{a}	3058^{a}
	10,000	4001^{a}	3847^{a}	3847^{a}
Sole waterleaf	0	1250^{c}	930^{c}	580^{c}
	2500	1790^{b}	1300^{b}	820^{b}
	5000	2150^{b}	1868^{b}	980^{b}
	7500	3800^{a}	2610^{a}	2026^{a}
	10.000	3998^{a}	2914^{a}	2143^{a}
Intercropped	0	1200^{c}	806^{c}	140^{c}
Green Waterleaf	2500	2180^{b}	1023^{b}	740^{b}
	5000	2050^{b}	1850^{c}	930^{b}
	7500	3870^{a}	2459^{a}	1770^{a}
	10.000	3985^{a}	2540^{a}	1849^{a}

Means followed by different letter(s) within a column differ @P=0.05. Duncan's Multiple Range Test.

Amaranthus cruentus and talinum triangulare were used as the test crops. Sampling of some growth parameters were made. Also weed weight measurements were made including post harvest soil analysis to determine the level of improvement the poultry manure application had on the degraded ultisol.

Data Analysis: Data was analyzed using the Least Significance Difference (LSD) and Dauncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Mean number of leaves: The results generally show that the application of higher quantities of poultry manure 7500 and 10,000kg ha^{-1} gave the highest number of leaves per plant and were significantly different ($p \geq 0.05$) from the plots with 2500, 5000 and 0.kgha^{-1} poultry manure. Thus the number of leaves per plant was dependent on the quantity of nutrient made available from the poultry manure applied and not the cropping system used. However, the poultry manure application in intercropping *Amaranthus cruentus and Talinum trianglare* showed diminishing leaf production of the vegetables after 7500kg ha^{-1} was applied indicating that addition of more manure was unnecessary after that point.

Fresh Weed Weight: Weed infestation and weight $kgha^{-1}$ increased with increasing poultry manure rates. Weed fresh weights were low in all plots without poultry manure (control plots). Weed infestation / weight increased as the soil fertility improved. However, the weeding intervals reduced the weed number and fresh weight. There were significant differences between 7500, 10.000$kgha^{-1}$ and 5000, 2500$kgha^{-1}$ on one hand and the control on the other hand. This indicates the level of fertility improvement and nutrient release in the degraded ultisol as a result of poultry manure application in weed productivity. This agreed with[7,9,11] who investigated the use of organic residues as a viable option in improving and sustaining soil productivity. The rapid increase of weed fresh weights gave an indication of the ability of weeds to survive in any environment especially when conditions of the soil are favourable.

Poultry manure rates and soil fertility status after the experiment

Sole Cropping, Green and Waterleaf: The results show that soil nutrient status diminished under control plots (0kg ha^{-1}) for sole cropping in Ca and Mg, the Organic matter percentage was also reduced but these were not statistically significant. However, there was a gradual increase in soil fertility from the application of 2500 kg ha^{-1} to 10.000kg ha^{-1} poultry manure. The 7500 and 10,000 kg ha^{-1} applied was significantly different from the 2500 and 500 kg ha^{-1}. The increase in soil $_{p}$H was not significant differences between %soil OM and %N and the pattern indicates a strong relationship between the two soil chemical components and $_{p}$H. There were diminished soil fertility states in control plots. This may be as a result of nutrient uptake by the vegetable crops and low yield could be traced to this. This agreed with[12].

Intercropped Green Waterleaf: The results show a decline in soil N, in all plots with O kg ha^{-1} but increase in the plots that were applied with poultry manure (2500, 5000, 7500 and 10,000 kg ha^{-1}) respectively. This agreed with Ibeawuchi and Ofoh 2003 that percentage soil total N generally declined in all plots at the end of the experiment but was not significantly different when compared with the initial soil N. There were significant differences among the plots with different rates of poultry manure. Plots with high quantities of poultry manure 10,000 and 7500 kg ha^{-1} maintained high quantities of the major nutrient NPK and the secondary nutrients Ca and Mg. Organic matter which has a strong relationship with %total soil N also increase with increasing poultry manure. However, there were observable differences between the sole crop plots and intercropped plots. These observable differences show that in intercropped plots, more nutrients were taken up per plot than in sole crop plots. However, lots of factors are involved in the availability and unavailability of mineral nutrients[13] because of the soil dynamics.

In rating for soil fertility classes, the soil with 3.39% and 3.00% OM, 0.84% and 0.74% N, 13.45 and 13.40 ppm P and 0.75 and 0.76 Cmol kg^{-1} K for sole green and sole waterleaf, respectively has higher fertility rating than the intercropped plots with 3.07%,)M, 0.70% N, 13.18ppm P and 0.74 Cmol kg^{-1} K, this agreed with Enwezor *et al.,*[14] .

CONCLUSIONS

Poultry manure has great potentials in the improvement of degraded ultisol. There is high nutrient uptake by crops in crop mixtures and therefore requires high fertile soils to thrive in.

It is recommended that poultry manure be used to improve infertile soils and increase productivity in intercropping systems for a sustained soil and good crop yield.

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