EFFECT OF DIFFERENT RATES OF ABATTOIR EFFLUENT ON GROWTH OF MAIZE (*Zea mays*) AND SOME CHEMICAL PROPERTIES OF SOIL IN IGBARIAM, SOUTH EASTERN, NIGERIA.

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ABSTRACT
A study was carried out in Teaching and Research Farm of the Faculty of Agriculture, Chukwuemeka Odumegwu Ojukwu University, Igbariam Campus in Anambra state of Nigeria to investigate the effect of different rates of Abattoir Effluent on growth of Maize (*Zea mays*) and some chemical properties of soils in Igbariam, South eastern, Nigeria. The experiment was laid out in Randomized Complete Block Design (RCBD) with four levels of treatments comprising Control (No Treatment); 20,000 L / ha Abattoir Effluent (AE), 40,000 L / ha AE and 60,000 L / ha AE. The treatments were replicated four times and data collected were analysed following the analysis of variance (ANOVA) for Randomized Complete Block Design (RCBD). Treatment means were separated with Least Significant Difference. Results obtained showed that, there was significant difference among the different rates of Abattoir Effluent both on growth parameters of maize plant and some chemical properties of Soil in Igbariam, Anambra State. The different rates of Abattoir treatments were at par but had great effect when compared with the control. The value of Number of leaves, Plant height, stem girth and leaf area recorded increased as the Week After Planting (WAP) and quantity of Abattoir Effluent increased. The highest values of plant height (77.45cm), Number of leaves (13.53), leaf area (104.25cm^2) and stem girth (8.73cm) were obtained where Abattoir Effluent was applied at the rate of 40,000 L / ha and 60,000 L / ha Abattoir Effluent. The results also revealed that Abattoir Effluent greatly increased the content of Organic Matter, Total Nitrogen and Available Phosphorous in the soil. It is therefore, recommended that Abattoir Effluent can be used as soil amendment for increasing soil fertility of the study area.

Key words: Abattoir Effluent, Soil Chemical Properties, Soil amendment, Soil Fertility.

INTRODUCTION

Maize (*Zea mays*) is an important cereal and staple food crops in the tropics and forms a major source of income to many farmers in the developing countries. Maize is cultivated extensively in the Northern and Southern parts of Nigeria in Soils, rich in organic matter. Obtaining high yield of maize is dependent on the supply of mineral nutrients in the form of organic and inorganic fertilizers to the soil. However, the scarcity and high cost of inorganic fertilizers in the South East and its associated negative effects such as acidifying the soil when ammoniacial fertilizers (e.g. Ammonia, Urea, etc.) are applied, have shifted attention of researchers to continue to explore other sources of organic manure for increasing the soil fertility and yields of crops. The use of organic manures such as cow dung, poultry droppings, household refuse and crop residues for crop production has been an usual practice among the subsistence farmers in West Africa since the prospect of obtaining adequate chemical fertilizers to meet the requirement of the large farming population is challenging (Lombin *et. al*., 1991; Osemwota, 2010; Nweke and Nsoanya, 2015; Nsoanya and Nweke, 2015).

Abattoir is defined as a specialized facility approved and registered by the regulatory authority for inspection of animals, hygienic slaughtering, processing, effective preservation and storage of meat products for human consumption, (Alonge, 2011).

Waste water or effluent generated from the abattoir is characterized by the presence of a high concentration of whole blood of slaughtered food animals and suspended particles of semi-digested and undigested feeds within the stomach and intestine of slaughtered and dressed food animals (Coker *et al*, 2001). Simply put, abattoir effluent comprises blood, urine, feces and water of the slaughtered animals like cattle, sheep, goat, etc. (Adesemoye, *et al*., 2006; Osemwota, 2010).

In Nigeria, adequate abattoir waste management is lacking in all public abattoirs such that, large solid wastes and effluents are piled up around the abattoirs (Adeyemo, 2002). These solid wastes and effluents should be utilized for agricultural production as organic manure in order to improve Soil fertility and crop yields. Osemwota (2010) revealed that, abattoir effluent increased the pH and available Phosphorus of the Soil.

Hence the objective of this study was to investigate the effect of different rates of abattoir effluent on growth of maize and some chemical properties of soil in Igbariam; South eastern Nigeria.

MATERIALS AND METHODS

Site Location

The study was carried out in the Teaching and Research Farm of Faculty of Agriculture, Chukwuemeka Odumegwu Ojukwu University, Igbariam Campus, Anambra State, Nigeria. The experimental site was situated between Latitude 06^0 14" N and Longitude 06^0 45" E (Anambra State Ministry of Science and Technology Met, Station,

Igbariam, Anambra State). The rainfall pattern is bimodal between April and October.

The mean monthly temperature is between 23^0C and 32^0C while the total rainfall ranges between 1500mm and 1900mm. The Relative Humidity RH) of the study area is moderately high and the highest RH amounts to 89%; while the lowest RH (50%) was obtained during dry season. The soil of the study area is of the sandy loam texture class classified as Utisol (FDALR, 1985).

Land Preparation; Experimental Design and Treatment Allocation:

The experimental field measuring 15m by 15m ($225m^2$) was cleared and tilled using hoe. The experiment was laid out in a Randomized Complete Block Design (RCBD) which consisted of four treatments and four replications to give 16 plots.

The size of each plot measured 2m x 2m ($4m^2$) with a distance of 1m between the plots and each block was separated by 2m alley. Treatment material (abattoir effluent) was applied at the stipulated rates to the plots, two weeks before planting to allow for decomposition and mineralization of the solid particles of the effluent. The treatment material applied was as follows:- Abattoir Effluent (AE) OL / plot equivalent to OL / ha (control); AE 8 L / plot equivalent to 20,000 L / ha; AE 16 L / plot equivalent to 40,000 L / ha; and 24 L / plot equivalent to 60,000 L / ha. Two seeds of maize hybrid (oba super 2) were planted per hole at the spacing of 75cm x 25cm and at a depth of about 3cm – two weeks after the application of Abattoir effluent.

Later, the seedlings were thinned to one plant per hole and empty stands were supplied. Weeding was done manually using hoe at two weeks interval till harvest.

Data Collection

Data collection on growth parameters of maize such as plant height, stem girth, number of leaves and leaf area were measured at the 7^{th} and 8^{th} weeks after planting (WAP). Six maize plants were randomly selected and tagged from each plot for the measurement of the growth parameters, number of leaves was done by visual counting and the mean was calculated. Plant height (cm) was measured using a carpenter's tape from ground level to the topmost leaf and the mean was calculated. Stem girth (cm) was measured using a tailor's tape in each plot and the mean was calculated.

Leaf area was determined by the area destructive length x width method using the relation: Leaf Area = 0.75 (L x W), where 0.75 is a constant.

Composite soil samples randomly collected from different locations of the experimental field at a depth of 0 – 20cm before application of treatment material were air dried, crushed and sieved with a 2mm sieve and used for the analysis of physical and chemical properties of the soil prior to the application of treatment material (Table 1). At the end of the study, soil samples were collected from each plot for determining some chemical properties such as pH, organic matter, total Nitrogen and available phosphorus, Soil pH was determined using glass – electrode pH meter; organic matter was determined by Walkley and Black (1934) wet oxidation method. Total Nitrogen was determined using Kjeldahl digestion method of Black *et al.*, (1965). While Available Phosphorus was determined by the method of Bray and Kurtz (1945).

Data Analysis

Data generated from he study were subjected to an analysis of variance test based on Randomized Complete Block Design (RCBD). Statistical significance between treatment means was estimated using Least Significant Difference (LSD 0.05) according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

Results obtained in the study revealed that, there was significance (P = 0.05) among the different rates of abattoir effluent both on growth parameters of maize plant and some chemical properties of soil in Igbariam, Anambra State. Table 2 showed that, different rates of abattoir effluent increased the growth parameters (namely: Number of leaves, plant height, stem girth and leaf area of maize when compared with the control) as the weeks after planting and rates of abattoir effluent increased. The highest values of plant height (72.45cm) stem girth (8.73cm) and leaf area ($104.25cm^2$) were obtained at 8 WAP at the plot where abattoir effluent was applied at the rate of 60,000 litres / ha while the highest value of Number of leaves (13.53) recorded was obtained at the plot where abattoir effluent applied at the rate of 40,000 litres / ha. The reason for the increase in these growth parameters could be as a result of the nutrients released from the decomposition and mineralization of the organic matter and solid wastes contained in abattoir effluent.

Table 1: Physical and Chemical properties of Soil of the Experimental Site before Treatment.

Soil Properties	Value
Particle size g/hg	
Clay	70
Silt	90
Fine sand	390
Coarse sand	450
Textual class	Silt loam
Chemical characteristics	
pH (H_2O)	5.8
pH (KCl)	5.0
Organic (g/kg)	5.2
Organic matter (g/kg)	9.0
Total Nitrogen (%)	0.42
Available P (Mg / kg)	1.87
Exchangeable bases (cmol/kg)	
Na^+	0.24
Ca^{2+}	1.40
K^+	0.20
CEC	12.40
Exchangeable Acidity (cmol/kg)	1.20
Base Saturation (%)	35.81

CEC=cation exchange capacity

Table 2: Effect of different rates of Abattoir Effluent on Growth parameters of Maize (Zea mays).

Treatment	Number of Leaves WAP		Plant height (cm) WAP		Stem girth (cm) WAP		Leaf area (cm^2) WAP	
	7	8	7	8	7	8	7	8
Control (No treatment)	11.01	11.05	39.4	45.25	5.83	6.55	91.5	95.75
AE – 20,000 L / ha	12.43	13.05	60.1	66.28	7.08	7.78	93.25	96.75
AE – 40,000 L / ha	12.85	13.53	65.03	70.83	7.80	8.45	98.25	103.00
AE – 60,000 L / ha	12.5	13.28	67.25	72.45	8.04	8.73	100.25	104.25
LSD 0.05	0.32	0.35	8.02	5.06	0.19	0.79	7.23	6.88

AE – Abattoir Effluent. WAP – Weeks after Planting, LSD – Least Significant Difference.

Table 3 indicated that, different rates of abattoir effluent had great effect on some chemical properties in the study area. Abattoir effluent increased the soil organic matter Total Nitrogen and Available Phosphorus – when compared with the control. The highest values of Organic Matter (1.29%); Total Nitrogen (0.079%); and Available Phosphorus (2.25Pp) were recorded at the plot where abattoir effluent was applied at the rate of 60,000 L / ha. The order of increase of these soil chemical properties is as follows:- AE 60,000 L / ha > AE 40,000 L / ha > AE 20,000 L/ha > control. The results obtained in the study area are in line with the reports of other researchers. Batiano and Mokwunye (1992), Nweke and Nsoanya (2013) reported that, the application of organic material physiochemical properties. The results obtained on soil chemical properties are also supported by the study of Osemwota (2010) who reported that abattoir effluent increased the pH and Available Phosphorus.

Table 3: Effect of different rates of Abattoir Effluent on some Chemical Properties of Soil Igbariam.

	pH		**Organic Carbon**	**Organic Matter**	**Total nitrogen**	**Available Phosphorus**
Treatment	**H_2O**	**KCL**	**(%)**	**(%)**	**(%)**	**(mg/kg)**
Control (No treatment)	5.3	4.3	5.6	9.6	0.56	1.87
AE – 20,000 L / ha	5.6	4.7	6.0	10.3	0.75	2.10
AE – 40,000 L / ha	5.7	4.9	6.6	11.4	0.77	2.10
AE – 60,000 L / ha	5.8	5.2	7.5	12.9	0.79	2.56
$LSD_{0.05}$	NS	NS	0.22	0.25	0.29	0.69

LSD=Least Significant Difference

The study revealed that, abattoir effluent at the rate of 60,000 litres / ha and 40,000 litres / ha can be applied by farmers in the study area as organic manure to improve soil fertility status, and subsequently increase plant growth and yield of crops since abattoir effluent is rich in Organic Matter Total Nitrogen and Available Phosphorus. Again, abattoir effluent is quite cheap when compared with the more costly inorganic fertilizers or other forms of organic manure like – cow, pig, goat, sheep dung, poultry droppings etc.

REFERENCES

Adesemoye, A. O.; Opere, B. O.; and Makinde S. C. O.; (2006) Microbial content of Abattoir Waster water and its contaminated soil in Lagos, Nigeria Afr. J. Biotechnol. 5 (20); 1963, 1968.

Adeyemo, O. K. (2002), unhygienic operation of a city abattoir in South Western, Nigeria; Environmental implication. African Journal of Environmental assessment and Management, 4 (1); 23 – 28.

Alonge D. O. (2001) Textbook of Meat Hygiene in the tropics, 5th edition, Farmcoe Press Ibadan, Nigeria pp. 61.

Batiano, A. and Mokwunye, A. U. (1992) role of manures and Crop residue in alleviating soil fertility constraints to crop production with special reference to the Sahelian and Sudanian zones of West Africa. Fertilizer Research. 29: 217 – 225.

Black, C. A.; Evans, D. D.; White, J. I. Ensmingen, L. E. and Clark, F. E.; (1965), Methods of soils analysis, part 2; Agronomy; Madison; Soil Science Society of America.

Bray, R. H. and Kurtz, L. T. (1945); Determination of total organic and available forms of phosphorus in soils. Soil Science 59; 39 – 48.

Coker, A. O.; Olugasa, B. O.; Adeyemi, A. O. (2001) Abattoir waste water quality in South Western, Nigeria. Proceedings of the 27th WEDC; Conference Lusaka, Zambia, Loughborough University press, United kingdom; 329 – 331.

FDALR (1985) Reconnaissance Soil Survey of Anambra State, Nigeria, Soil Report FDALR Kaduna.

Lombin, L. G.; Adepetu, J. A.; and Ayotade, K. A.; (1991). Complementary Use of Organic Manure and Inorganic Fertilizers in Arable crop production. Proceedings of a National Organic fertilizer Seminar, Kaduna, Nigeria, 146 – 162.

Nsoanya, L. N. and Nweke; I. A. (2015); Effect of Integrated use of Spent Grain and NPK (20:10:10) Fertilizer on Soil Chemical Properties and Maize (Zea mays), Growth. International Journal of Research in Agriculture and Forestry; Vol. 2, Issue 3; pp. 14 – 19.

Osemwota, O. I. (2010); Effect of Abattor effluent on the physical and chemical properties of Soils. Environ. Monit. Assess. 167; 399 – 404.

Steel, G. D. and Torrie, J. H. (1980), Principles and procedures of Statistics – A biometrical approach; 2nd edition, McGraw, Hill book Co. Inc. New-York Pp. 633.

Walkley, A. and Black, I. A. (1993), An examination of the Degtjareff method for determining soil organic matter and the proposed modification of the chromic acid titration method Soil Science 37: 29 – 38.