

COMPARATIVE EFFECTS OF POULTRY MANURE AND POULTRY MANURE BIOCHAR ON THE PERFORMANCE OF MAIZE (*Zea mays*) IN RIVERS STATE, SOUTHERN, NIGERIA

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Abstract: Pot experiment was conducted in the teaching and research farm of the department of Agriculture, Ignatius Ajuru University of Education to determine the comparative effect of poultry manure and poultry manure Biochar on the performance of maize (*Zea mays*). The treatments consisted of five levels of poultry manure (PM) 0g, 20g, 40g, 80g and 120g and five levels of poultry manure Biochar (PMB) 0g, 20g, 40g, 80g and 120g. The experiment was a 5 x 5 factorial arranged in a randomized complete block design and replicated three times. Data collected were plant height at 2, 4, 6 and 8 weeks, leaf area, number of leaves, weight of the cob, cob length girth, weight of 100 seeds. The result shows that the height of maize plant was significantly higher in poultry manure and poultry manure biochar compared to the control plants (zero application). Poultry manure biochar (PMB) at eighth (8th) week produced the tallest plant with 80g application. All the treatment had no effect on the number of leaves produced but PMB had appreciably higher effect on the size of maize leaves and total leaf area compared to PM. Poultry manure (PM) produced plants with bigger cobs, higher cob weight and seed weight with 40g application. While in the case of PMB plants that received 80g PMB had the best value in terms of cob size, cob weight, but 40g had the height seed weight. 40g PM per plant application is recommended for maize production. When PMB is used 80g PMB per plant is recommended

Keywords: Poultry manure, Biochar, Soil amendment, Maize production, Rivers state, Nigeria.

I. INTRODUCTION

Maize (*Zea mays*) belongs to grass family Poaceae and genus *Zea* maize has its origin from Mesoamerican region in Mexico highland (Flanny 2001, Famham et al 2003). Maize is a tall annual and monoecious plant with fibrous root system (Dhillon and Prasanna 2001)

The crop is highly regarded for its ability of adaptation to wide range of climate and it is distributed across large area more than any other local crop (Ibeawuchi et al 2008) Maize is the third most important cereal after rice and wheat in terms of cultivation and production (Osagie et al 1998). It has numerous uses in different countries ranging from production of food for man, feed for livestock and production of (ethyl alcohol) ethanol. Other uses of corn include production of corn oil (for cosmetics, lubricants, medicine), production of starch for making degradable plastics fibre and adhesives. (Enujeke 2013; Dipa 2006)

Poultry manure is a soil additive organic amendment obtained from the droppings or litter of farm animals such as chicken, turkey, etc. used across the globe in place of chemical fertilizer to restore and promote the physical, chemical and biological conditions of the soil (Barrett 2008). Poultry manure is very rich in all essential nutrients required for the growth, development and yield of plants. Examples of such nutrients are nitrogen, phosphorus, potassium, calcium magnesium, Sulphur, manganese, copper, zinc, chlorine, boron, iron, and molybdenum, (Asae 1998, Patterson et al 1998). It promotes nutrient uptake and plant productivity and richer in mineral that supports the growth of plant and micro organisms than all other sources of manure (Mohammed et al 2010; Ojeniyi et al 2013 Gulshan 2013)

Poultry manures are biodegradables that boost the fertility of soil, supports plant growth and increase yield and when added to the soil supported the growth and yield of crops more than goat and cow manure.

The use of poultry manure on degraded soil encouraged the production of good size leaves and promoted the level of chlorophyll in leaves of maize and sorghum. According to Brady and Well (1999), poultry manure is easily converted to useful and required nutrients by plants than dung of pig and cattle and Fagami and Odebode (2007) reported that plant height, number of leaves and fruits of pepper increased when 10t/ha and 20t/ha of poultry manure was used.

Biochars are burnt plant and animal material rich in carbon derived from slow pyrolysis of biomass (Chan et al, 2008; Glaser et al, 2002).

Biochar is a porous carbonaceous solid produced by thermo-chemical changes of plants and animal matters in the environment with low oxygen. It has both physical and chemical properties that make storage of carbon in the environment safe and longer and for soil improvement (Steinbeiss et al 2009). Biochar is an important source of calcium, magnesium, potassium to plant, it also retains nutrient for plant uptake. Biochar also slowly releases nutrient to plants. (Laird 2008, Liang et al 2008, Woolf et al 2010). According to Uzoma et al (2011), the height of plants and number of leaves increases at any point biochar is applied.

Despite the usefulness of maize, its production is faced with several constraints limiting its productivity and yield in Africa low below 1 ton/ha due to such factors as poor soil fertility, negligence of soil amendment materials, drought, parasites, stress, inadequate access to quality input (fertilizer), poor mechanization and poor harvesting management (Dipa 2006; Enujeke 2013; Dias et al 2009).

The objective of this study is to evaluate the effect of poultry manure and poultry manure biochar on growth and yield of maize.

II. MATERIALS AND METHODS

The experiment was carved out of the Teaching and Research Farm of Ignatius Ajuru University of Education, Department of Agriculture, Faculty of Vocational and Technical Education Ndele campus. Ndele is in Emohua Local Government Area of Rivers State, located in the southern rainforest, with about 250 mm to 100 mm of annual rainfall. The experiment site was cleared from its vegetative cover manually and stumped. The soil was tilled, and part of the soil dug out to fill the perforated poly bags(pots) used for the study. Implements used for the work include machete, spade, head pan, hoe and measuring tape.

Improved yellow maize hybrid "oba supper 6" seeds which was obtained from Rivers State Agricultural Development Program (ADP) Rumuodamaya, Port Harcourt was used.

The experiment was laid out in randomized complete block design, with two factors poultry manure (PM) and poultry manure biochar (PMB) at the rate of 0 g, 20 g, 40 g, 80 g, and 120 g of application replicated three times to give 2 x 5 x 5. Perforated poly bags(pots) were filled with soil dug from the experimental site. Twelve pots were treated with poultry manure and another twelve were treated with poultry manure biochar while six bags were filled with zero treatment. Each treatment lasted one week, after incorporating with the soil before 3 seeds per pot were sown with a spacing of 50 cm x 1 m and depth of 2 – 3 cm. Seedlings were thinned to one, a week after planting.

Poultry manure biochar (PMB) was prepared by collecting of litters from laying birds, which were then put into an airtight smoking kiln and heated till it burnt into char. The burnt manure was crushed to make it homogeneous and stored in airtight container from where it was measured and used in the study. The agronomic parameters observed and measured

were plant height at 2, 4, 6 and 8 weeks after planting, leaf area, number of leaves, weight of cob, cob length and cob girth, and weight of 100 seeds.

Data collected were subjected to analysis of variance of the randomized complete block design and means separated by least significance difference (LSD) at P = 0.5 using the statistical package for social science (SPSS).

III. RESULTS AND DISCUSSION

A. The Effect of Poultry Manure and Poultry Manure Biochar On Growth Of Maize

The effect of poultry manure and poultry manure biochar on growth of maize is shown in Table 1. Both poultry manure and poultry manure biochar had significant effect on the height of maize plant compared to the zero application. The highest height of maize plant was obtained at the rate of 80 g per plant in both poultry manure and poultry manure biochar. But the poultry manure biochar (PMB) produced the maize plant with the highest height of 217 cm at 8 weeks 80 g application than poultry manure with highest height of 208 cm. This result agrees with Asai et al. 2009 and Wisnobiok et al. 2017 that observed that biochar application helps in improving the condition of soil and plant. Uzoma et al. (2011), in his study also observed that plant height increased at any point biochar was applied.

TABLE 1: EFFECT OF POULTRY MANURE AND POULTRY MANURE BIOCHAR ON MAIZE PLANT HEIGHT

	WEEKS AFTER PLANTING			
	2	4	6	8
POULTRY MANURE (g)				
0	24.33 ^a	60.33 ^a	112.33 ^a	130.33 ^a
20	32.67 ^b	77.00 ^b	138.33 ^b	207.33 ^c
40	36.33 ^b	38.33 ^b	151.67 ^c	201.67 ^c
80	44.67 ^c	86.67 ^b	157.00 ^b	208.33 ^a
120	52.33 ^a	92.33 ^c	153.33 ^c	170.67 ^c
S.E.	2.618	3.749	8.435	18.983
POULTRY MANURE BIOCHAR (g)				
0	24.33 ^a	60.33 ^a	112.33 ^a	130.33 ^a
20	28.33 ^b	60.67 ^a	126.67 ^a	167.67 ^b
40	46.00 ^c	91.00 ^b	158.00 ^b	210.67 ^a
80	45.00 ^c	102.67 ^b	171.67 ^c	217.67 ^c
120	42.16 ^c	97.33 ^b	170.33 ^c	216.67 ^c
S.E.	2.61	3.749	8.435	18.983
F X R	*	*	*	*

Means with the same alphabet in the same column are not significantly different at P = 0.5 by L.S.D * = Significant

B. The Effect of Poultry Manure and Poultry Manure Biochar on Yield Characteristics Of Maize.

The effect of poultry manure and poultry manure biochar on yield characteristics of maize is shown in Table 2. It was observed that poultry manure produced the best cob length than poultry manure biochar in all the rates of application. The best cob weight and girth from poultry manure was produced from 40 g whereas poultry manure biochar, produced the best cob weight and cob girth at the rate of 80 g. While 40 g application rate of both poultry manure and poultry manure biochar produced the best seed weight of 33.00 g each. This result shows that the best rate of application of poultry manure is 40 g and the best for poultry manure biochar is 80 g for better yield. Comparatively, poultry manure produces better yield than poultry manure biochar. This observation is supported by the report of Adeniyi and Ademoyegun (2012) who observed that the best yield of tomato was obtained with increasing level of poultry manure. Chan et al. (2008) reported that biochar can promote good yield in crops when applied.

TABLE 2: EFFECT OF POULTRY MANURE AND POULTRY MANURE BIOCHAR ON YIELD OF MAIZE

	YIELD CHARACTERISTICS OF MAIZE			
	COB LENGTH (cm)	COB GIRTH (cm)	COB WEIGHT (g)	WEIGHT OF SEEDS (g)
POULTRY MANURE (g)				
0	10.33 ^a	9.679 ^a	40.33 ^a	23.33 ^a
20	15.33 ^b	14.15 ^b	112.50 ^a	31.00 ^b
40	15.33 ^b	16.13 ^c	163.00 ^c	33.00 ^c
80	15.33 ^b	14.80 ^b	122.67 ^b	28.67 ^b
120	15.25 ^b	15.50 ^b	165.00 ^c	31.67 ^b
S.E.	1.6	8.73	10.114	7.96
POULTRY MANURE BIOCHAR (g)				
0	10.33 ^a	9.67 ^a	40.33 ^a	23.33 ^a
20	10.67 ^a	12.33 ^b	76.50 ^b	26.33 ^b
40	13.67 ^c	13.47 ^c	72.50 ^b	33.00 ^c
80	14.33 ^c	14.60 ^c	101.000 ^c	27.33 ^b
120	12.00 ^b	11.00 ^b	80.00 ^b	27.00 ^b
S.E.	1.65	8.73	10.114	7.96
F X R	*	*	*	*

Means with the same alphabet in the same column are not significantly different at P = 0.5 by L.S.D * = Significant

IV. CONCLUSIONS

The study was conducted to evaluate comparable rates of poultry manure and poultry manure biochar on the performance and maize, the result of the study showed that the application of poultry manure and poultry manure biochar had significant effect on the cultivation of maize. Poultry manure (PM) produced plants with bigger cobs, higher cob weight and seed weight with 40g application. While in the case of PMB plants that received 80g PMB had the best value in terms of cob size, cob weight, but 40g had the height seed weight. 40g PM per plant application is recommended for maize production. When PMB is used 80g PMB per plant is recommended.

REFERENCES

- [1] Adeniyi. H., and Ademoyegun, O. (2012). Effect of different rates and sources of fertilizer on yield and antioxidant component of tomato. *Agric journal* 7:135-138.
- [2] Ano, A.o., Aholu, J.A., (2006). Effects of animal manure on selected soil properties: 11. Nitrogen, potassium and phosphorus. *Nigeria Journal soil science*; 16: 145-150.
- [3] Asae. (1998) D3841 manure production and characteristic in: ASAE standards, ASEA , st joseph , m149085-9656.
- [4] Asai et al (2009). Biochar Amendment techniques for upland rice production in northern Laos. *Soil physical properties, leaf SPAD and grain yield field crops* RS. 111:81-84.
- [5] Barrett, J (2008) FCS soil science 3. FET college series. pearson education south africa.p.70.
- [6] Brady, C. and Wails, R.R (1999) *Nature and properties o soil*. Twelfth edition, printice Hall, new Delhi. Pp74-114.
- [7] Chan, key, Van Zeiten, L., Meszaros,L., Dowwnie, A and Joseph , S. (2008). Using poultry letter biochar as soil amendment. *Austrilian Journal of soil research, Vol.46, No. 5 p (437-444) ssn (0004-9573)*.
- [8] Dias, B. O., Silva, C. A., Higashikawa, F. S., Roig, A., and Sanchez-Monedero, M. A. (2009). Use of biochar as a bulking agent for te composting of poultry manure: Effect on organic matter degradation and humification. *Bioresource Technology*, 101, 1239-1246.

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- [9] DIPA (2006). Handbook of Agriculture: facts and figures for farmers, students and all interested in farming. Directorate of Information and Publications of Agriculture. Indian Council of Agricultural Research, New Delhi, (p. 435).
- [10] Enujoke, E.C (2013) *Effect of variety and spacing on growth characters of hybrids maize. Asian journal of agriculture and Rural Development . 3(5) page 296-310.*
- [11] Fagimi, A.A , and odebode C.A; (2007) *effect of poultry manure on pepper veinal motlle virus (PVMV), yield and agronomic parameters of peeper (capsicum anuum) in nigeria. East africa journal of science 1 (2): 104-111.*
- [12] Farnham, D.E., Benson, G.O., Pearce, R.B., (2003). *Corn perspective and culture.* Chapter 1. In P.J white, LA Johnson, eds. Corn chemistry and technology, second edition American Association of cereal chemiscals. Inc. st. paul, minesota, U.S.A . pp1-33.
- [13] Flanning (2001) A single domestication for maize shown by multilocus microstate. *Canadia Journal of Archaology/Journal canedien and Archeologie 38:348 (2014)*
- [14] Glaser, b; lehmann, J. and Zech, W., (2002). Ameliorating physical and chemical properties of highly weathered soil in the tropics with charcoal –a review . *Biology and fertility of soil vo.33 N0, 4 page (219-230)ISSn 0178-2762.*
- [15] Glaser, b; lehmann, J. and Zech, W., (2002). Ameliorating physical and chemical properties of highly weathered soil in the tropics with charcoal –a review . *Biology and fertility of soil vo.33 N0, 4 page (219-230)ISSn 0178-2762.*
- [16] Ibeawuchi, I.I, opara, F.A tom, C.T., and obiefuna, J.C , (2007). Graded replacement of inorganic with organic manure for sustainable maize production in owerri; imo state , nigeria. *Life science journal 4(2): 82-87 (ISBN: 1097-8135).*
- [17] Laird, D. A. (2008). *The charcoal vision: A win-win-win scenario for simultaneously producing bioenergy, permanently sequestering carbon, while improving soil and water quality. Agronomy, J. 100:178-181.*
- [18] Liang, B., lehmann. J., Solomon, D., Sohi, S., Thies J.E skie Mstad J.O., Luizao, F.J., Engelhard, M,H neves F.G wirk,s, (2008) stability of biomass-drives . back carbon in soils. *Geochemic et cosmochmica Acta 72, 6078-6096..*
- [19] Mohamed, A.M., Sekar, S., muthukrishnan, P.(2010) prospects and potential of poultry manure .*Asian journal . plant science 9:172-182.*
- [20] Ojeniyi, S.O., Amusan, O.A., Adekiya, A.O (2013). Effect of poultry manure on soil physical properties, nutrient uptake and yield of cocoyam (*xanthosoma saggitifolium*) in south west Nigeria. *America European journal agriculture environmental science 13(1) :121-125.*
- [21] Okeh et al 2003,
- [22] Osagie, A. U., and Eka, O.U., (1998). Nutritional quality of plant foods, 1st edition. *The post harvest unit, UNIBEN Nigeria. . pp. 62*
- [23] Patterson, P.H , lorenz, E.S. , weaver, W.S. Jr, (1998). Litter production and nutrients from commercial broiler chickens. *Journal of applied poultry research. 7:247-252*
- [24] Steinbeiss, s. gleixnor and antonieta, m; (2009). Effect of biochar Amendment on soil carbon, *soil balance and soil microbial activity. Soil biology and biochemistry, vol. 41, No.6. page 91301-13100)ISSn 00#*-1717.*
- [25] Uzoma, K. C., Inoue, M., Andry, H., Fujimaki, H., Zahoor, Z., and Nishihara, E. (2011). Effect of cow manure biochar and maize productivity under sandy soil condition. *Soil and Use Management, 27, 205-212.*
- [26] Wisnobiok et al. 2017
- [27] Woolf, D., Amanette, J.E., Abanyne street-perrott., F., leyman J., Joseph, S., *(2010). Sustainable biochar to mitigate global climate change nature communication 1:56, page 1-9.