Net Journal of Agricultural Science
Vol. 10(2), pp. 49-53, May 2022
DOI: 10.30918/NJAS.102.22.006
ISSN: 2315-9766
Full Length Research Paper

Effect of poultry manure and wood ash on the growth and yield of cucumber (*Cucumis sativum* L.) in Owerri Southeastern Nigeria

Emma-Okafor L.C.[1]*, Obijuru E.E.[1], Nwokeji I.M.[1], Echereobia C.O.[1] and Okoli N.A.[2]

[1]Department of Crop Science and Technology, Federal University of Technology Owerri, Nigeria.
[2]Department of Crop Science and Horticulture, Nnamdi Azikiwe Umiversity, Awka, Nigeria.

Accepted 9 May, 2022

ABSTRACT

An experiment was carried out at the Teaching and Research Farm of the Federal University of Technology, Owerri between April and June 2018 to determine the effect of poultry manure and wood ash on the growth and yield of cucumber in Owerri southeastern, Nigeria. The treatments consisted of 3 poultry manure rate (0. 5 and 10 t ha^{-1}) and 3 wood ash rates (0, 2 and 4 t ha^{-1}) laid in a 3 × 3 factorial *Randomized* Complete Block Design (RCBD). Data were collected on soil chemical properties, growth and yield parameters of cucumber, and were analyzed using ANOVA. Means were separated using Least Significant Difference (LSD) statistical method. Results showed that poultry manure and wood ash significantly affected the growth and fruit yield of cucumber. Soil amendment at 10 t ha^{-1} poultry manure and 4 t ha^{-1} wood ash recorded the highest number of leaves, vine length (cm) at 6 weeks after planting (47.10 and 127.6 respectively). Fruit yield (47.8 t ha^{-1}), fruit length (29.93 cm/plant) and number of fruit (7.67) per plot was highest with 10 t ha^{-1} poultry manure and 4 t ha^{-1} wood ash application but was least in 0 t ha^{-1} poultry manure and 0 t ha^{-1} wood ash (0.7, 7.00 and 1.33) respectively. On the basis of consistent higher production, it is recommended that 10 t ha^{-1} poultry manure and 4 t ha^{-1} wood ash be adopted in cucumber production in southeastern Nigeria.

Keywords: Poultry manure, wood ash, cucumber, growth, yield.

*Corresponding author. Email lilianokafor35@yahoo.com. Tel: +2348033888110.

INTRODUCTION

Cucumber *(Cucumis sativum L.)* is one of the important annual vegetable crops in the Cucurbitaceae family that has been cultivated by man for over 3,000 years (Adetula and Denton, 2003, Okonmah, 2011). Cucumber is a tender annual fruit vegetable vine crop grown for its fresh fruit (Onyia et al., 2012). It is cultivated for its soft and succulent fruits which are sources of minerals like Potassium, Magnesium, Phosphorus, Copper and Manganese, and vitamins A, C, K and B6 (Vimala et al., 1999).

The fruit is eaten alone as salad and in combination with other vegetables. The ascorbic acid and caffeic acid contained in cucumber help to reduce skin irritation and swelling (Okonmah, 2011). Its juice is often recommended as a source of silicon to improve the health and complexion of the skin. Cucumber controls the hypertension of the human body and also prevents kidney problems when eaten on regular basis (Duke,2000).

Infertile soils result in bitter and misshapen fruits which are often rejected by consumers (Eifediyi and Remison,2010).

In spite of the increasing relevance of cucumber in Nigeria, low yields are obtained in farmers' fields because of declining soil fertility due to continuous cropping and disregard for soil amendment materials. Application of poultry manure is one of the ways of improving soil fertility and the final yield of crops, poultry manure is reported as the richest known animal manure. Mangila et al. (2007) and Enujeke et al. (2013) indicated that poultry manure is not only cheap and effective but is also essential for establishing and maintaining the optimum soil physical conditions thereby activating soil microbial activities for the growth and yield of a plant.

Ewulo et al. (2008) and Agbede et al. (2008) reported that the application of 10 to 50 t ha^1 of poultry manure improves the soil's physical properties by reducing soil temperature and bulk density, and increasing the total porosity. Ash which is the inorganic and organic residue remaining after the combustion of wood, had been confirmed to be a good source of potassium, phosphorus, magnesium, calcium and micronutrients (Demeyer et al., 2001; Saarsalmi et al., 2001).

The incorporation of wood ash into the soil increased grain yields in crops. Previous studies had indicated that wood ash has the same liming effects as commercial lime, the result had confirmed wood ash gives better plant growth responses than limestone because of the additional nutrients that the wood ash contained (Awodun et al., 2007). Rodriguez et al. (2009) and Bougnom et al. (2009) in the investigation of the effects of wood ash fertilization on soil chemical properties observed that wood ash significantly increased the effective cation exchange capacity and base saturation and decrease the concentration of exchangeable aluminium in soil. The effects of poultry manure and wood ash help in increasing the chlorophyll content in cucumber. The demand for cucumber fruits is high due to their importance in our diet and their health benefit especially in stabilizing blood pressure. Hence, the study was undertaken to assess the productivity of cucumber using poultry manure and wood ash.

MATERIALS AND METHODS

Site location/description

This experiment was conducted in the School of Agriculture and Agricultural Technology Teaching and Research Farm, Federal University of Technology Owerri, Imo state, located between latitude 5°25°N and longitude 7°2°E in the tropical rain forest of Southeast Nigeria. The mean annual rainfall is between 1500 and 2500 mm from March to November and the temperature range of 25.5 to 31.9°C with a relative humidity of 82.6%. The experimental site measuring 420 m^2 (30 m × 14 m) was cleared, stumped, and trashed packed. The field was mapped out into plots using pegs, measuring tape and rope. Each plot measured 3 m × 3 m with an inter-plot spacing of 0.5 m and interblock spacing of 1 m. The plots were tilled and raised beds were made for the planting. The planting materials included improved cucumber seed. The seeds were obtained from IMO ADP, poultry manure from the FUTO poultry unit and wood ash from the FUTO canteen. Planting was done in April 2018. The seeds were sown on the plots at the rate of 2 seeds/stand at a spacing of 1 m × 1 m and a depth of 2.5 cm, the seedlings were later thinned to 1 seedling per stand.

Experimental design

The experiment is a 3 × 3 factorial fitted into a Randomized Complete Block Design (RCBD). The treatments consist of three rates of poultry manure (0, 5 and 10 tons/ha) and three rates of wood ash (0, 2 and 4 tons/ha). Weeding was carried out two weeks after planting using hands or hoe. While subsequent weeding was done as and when required. Staking was done 4 weeks after planting using bamboo sticks. Insects were controlled with neem extract as the need arose.

Data collection

All experimental plots were subjected to uniform cultural practices. Three representatives (sampling plants) of cucumber were selected from each plot (sample unit) and were tagged for the measurement of growth and yield characteristics.

The initial soil's physical and chemical properties were determined before planting. The soil sample was randomly collected from 0 to 20 cm depth from the experimental site with a soil auger and bulked. This was done to determine the initial nutrient status of the experimental site and at the end of the experiment, soil samples were collected from different plots to ascertain the effect of each treatment on the soil.

Statistical analysis

All data obtained were subjected to statistical analysis using the analysis of variance (ANOVA) as outlined by Genstat (2007). The mean separation was carried out using the least significant difference (LSD) at a 5% level of probability (Obi, 2002).

RESULTS

The result of soil analysis before planting (Table 1) showed that the soil was acid and low in mineral elements like organic matter (1.98%), % nitrogen (0.06) available phosphorus m/g (5.98) potassium c mol/kg (0.03). Results (Table 1) of postharvest soil analysis showed an increase in soil pH in all the treatments that receive poultry manure and wood ash, poultry manure alone, or wood ash alone when compared with the initial value before planting. There is also an increase in soil % organic matter, % nitrogen, available phosphorus, potassium and magnesium in treatments that received a mixture of poultry manure and wood ash as compared to their initial value before planting. However, there is little or no increase in nutrient elements in treatments that received zero application of poultry manure and wood ash when compared with the initial value.

The result (Table 2) showed significant differences (P = 0.05) among the various treatments in the number of fruits produced, 10 t ha^{-1} poultry manure + 4 t ha^{-1} wood ash gave the highest number of fruit per plants, this is similar to the number of fruits produced from 10 t ha^{-1} poultry manure + 0 wood ash, 10t ha^{-1} poultry manure + 2t ha^{-1} wood ash, 5 t ha^{-1} poultry manure + 4t ha^{-1} wood ash, and 5 t ha^{-1} poultry manure + 2 t ha^{-1} wood ash, but differed (p = 0.05) significantly from other treatments. The result (Table 3) showed significant differences among the various treatments on both fruit length and fruit girth per plant. Poultry manure, wood ash as well as interaction (Table 3) showed significant differences (P = 0.05) in the fruit girth of cucumber harvested. 0 wood ash, 10 t ha^{-1} poultry manure treatment had the highest value of girth and is highly different from 0 application, 0 poultry

Table 1. Effect of poultry manure and wood ash on soil chemical properties before planting and after crop harvest.

	pH in H_2O	% O.C	% O.M	APM/g	Mg	Ca	K	Na	% N	EA	AL
Pre-planting →	4.85	1.19	1.98	5.98	0.48	1.20	0.03	0.05	0.06	0.65	1.00
After harvest ↓											
0 poultry, 0 ash	4.86	1.10	1.16	5.00	0.48	1.20	0.03	0.01	0.06	0.65	1.00
0 poultry, 2 ash	6.22	1.41	1.54	9.76	3.2	4.5	4.00	0.63	0.211	0.48	0.80
0 poultry, 4 ash	6.61	1.418	1.723	9.75	3.9	5.9	4.014	0.073	0.233	0.48	0.80
5 poultry, 0 ash	5.691	1.797	1.891	9.66	3.4	4.6	8.589	0.051	1.40	0.16	0.96
5 poultry, 2 ash	5.40	1.837	2.145	6.2	2.3	4.8	5.825	0.053	1.140	0.08	0.832
5 poultry, 4 ash	5.60	2.256	2.166	7.18	3.18	5.8	5.018	0.056	1.411	0.208	0.688
10 poultry, 0 ash	5.70	2.198	2.01	9.68	3.8	4.8	8.08	0.061	1.81	0.194	0.66
10 poultry, 2 ash	6.10	2.296	2.235	8.02	2.7	5.0	6.536	0.062	1.321	0.192	0.64
10 poultry, 4 ash	6.18	2.458	2.791	9.49	2.8	5.4	8.948	0.059	1.45	0.192	1.12

Table 3. Effects of poultry manure and ash on the yield parameters of cucumber (number of fruit per plant, fruit length per plant, fruit girth per plant and fruit yield tha^{-1}) at harvest.

Treatments		Number of fruits per plant	Fruit length (cm) per plant	Fruit girth (cm) per plant	Fruit yield tha^{-1}	Shelf life tha^{-1}
Poultry manure tha^{-1}	Wood ash tha^{-1}					
	0	1.33	7.00	4.17	0.7	6.0
0	2	4.00	18.47	16.07	11.9	21.3
	4	4.00	21.77	16.17	20.3	34.7
	0	5.67	28.00	17.63	30.9	45.0
5	2	6.67	29.13	17.37	35.2	57.0
	4	7.33	29.73	18.37	41.4	58.7
	0	6.33	28.3	18.57	37.2	43.0
10	2	7.00	29.70	17.57	38.3	51.0
	4	7.67	29.93	17.77	47.8	59.3
LSD(0.05) Poultry manure		1.15	2.37	1.36	7.20	8.0
LSD(0.05) Wood ash		1.15	2.37	1.36	7.20	8.0
LSD(0.05) Poultry manure + wood ash		1.99	4.11	2.36	12.47	14.20

Table 2. Effect of poultry manure and wood ash on cucumber growth parameters (number of leaves, vine length (cm), stem girth (cm) and number of branches) at various stages of growth.

Treatments		Number of leaves		Vine length (cm)		Stem girth(cm)		Number of branches	
Poultry manure t ha^{-1}	Wood ash t ha^{-1}	4 WAP	6 WAP	4 WAP	6WAP	4 WAP	6 WAP	4 WAP	6 WAP
	0	2.67	7.67	7.0	19.7	1.50	2.00	0.00	0.67
0	2	5.00	17.33	16.2	69.3	2.33	2.67	0.83	1.33
	4	5.33	17.00	18.1	75.5	2.00	3.33	0.33	1.33
	0	7.33	41.67	40.1	123.9	3.67	4.33	1.33	3.00
5	2	7.67	41.00	37.2	121.1	4.00	4.33	1.33	3.00
	4	6.00	37.67	32.6	125.8	3.67	4.00	1.67	2.00

Table 2. Continues.

	0	5.67	40.10	29.5	121.1	3.67	4.00	1.67	2.67
10	2	5.00	36.00	30.7	117.1	3.00	3.67	1.67	2.33
	4	6.67	47.10	32.3	127.6	3.67	4.00	1.67	3.00
LSD(0.05) Poultry Manure		0.95	4.75	5.36	11.05	0.46	0.54	0.55	0.81
LSD(0.05) Wood Ash		0.95	4.75	5.36	11.05	0.46	0.54	0.55	0.81
LSD(0.05) Poultry manure + wood ash		1.64	8.24	9.28	19.14	0.80	0.93	0.95	1.39

manure + 2 t ha^{-1} wood ash and 0 poultry manure + 4 t ha^{-1} wood ash. The result of the fruit yield of cucumber (Table 3) showed that poultry manure, wood ash and interaction had a significant effect (P = 0.05) on the total yield of cucumber. The highest fruit yield (47.8 t ha^{-1}) was obtained from cucumber that received 10 t ha^{-1} poultry manure + 4 t ha^{-1} wood ash. This was closely followed by cucumber treated with 5 t ha^{-1} poultry manure + 4 t ha^{-1} wood ash. 10 t ha^{-1} poultry manure + 2 t ha^{-1} woodash, and 10 t ha^{-1} poultry manure.

However least yield was obtained from cucumber that received zero application of poultry manure and wood ash

The result (Table 3) also showed that poultry manure, wood ash and interaction significantly (P = 0.05) affected the number of days the harvested cucumber stayed before spoilage (shelf life).

Cucumber treated with 10 t ha^{-1} poultry manure + 4 t ha^{-1} wood ash stayed for a longer period (59.3 days) before spoilage followed closely by 5tha^{-1} poultry manure + 4tha^{-1}wood ash while the treatment that received zero application of poultry manure and wood ash stayed for a very short period of six days.

DISCUSSION

The result showed that the soil was acidic with low Organic matter (1.98%), % Nitrogen (0.06), Available Phosphorous m/g (5.98), and potassium cmol/kg (0.03). In support of this Ano and Agwu (2006) reported that animal manure increases soil pH and macronutrients of soil. Akande et al. (2003) reported that the application of organic materials could ameliorate slightly acidic soil to improve crop production. The finding of this study also agrees with the report of Brady and Weil (2004) on soil amendment properties of wood ash and poultry manure.

The result (Table 2) showed an improvement in all the growth parameters with the addition of poultry manure and wood ash mixture when compared with the zero application. This agrees with Senjobi et al. (2010) who reported that the use of poultry, plant and sheep/goat manures improved all the growth parameters of the leafy vegetable they worked with. However, the poor performance of the cucumber that received neither poultry manure nor ash also showed the positive effect of poultry manure in supplying the essential nutrient needed for plant growth. Mangila et al. (2017) reported that poultry manure is not only cheap and effective but also essential for establishing and maintaining the optimum soil physical conditions thereby activating soil micro activities for the growth of plants. The findings indicated that the addition of poultry manure and wood ash improved the fruit yield of cucumber (Table 3). Cucumber yield increase with an increase in the level of ash and poultry manure with the highest yield obtained from 10 tha^{-1} poultry manure + 4tha^{-1} wood ash. This indicates that a high level of poultry manure in a mixture of wood ash had an improvement in the yield of cucumber fruit. The one that received neither poultry nor wood ash not only produced low cucumber fruit but also had mainly misshaped fruits. This is in line with Ibeawuchi et al. (2007) and Fagimi and Odebode (2007). From the result of this experiment, poultry manure and wood ash have a positive effect on the shelf life of the harvested cucumber fruits. This shows that harvested cucumber from poultry manure and wood ash treatment could store for over one month without spoilage of fruits. Hence poultry manure and wood ash not only improve the yield of cucumber but also enhance the postharvest storage of the crop.

Conclusion

An increase in the rate of poultry manure and wood ash increased the number of leaves, vine length, number of fruits per plant, fruit length, fruit yield, and shelf life. Poultry manure at the rate of 10 tha^{-1} and wood ash 4 tha^{-1} gave the highest growth and yield followed by 5 tha^{-1} poultry manure and 4 tha^{-1} wood ash; while plots where poultry manure and wood ash were not applied recorded the lowest growth and yield.

RECOMMENDATION

Production of cucumber using 10 tha^{-1} poultry manure and 4 tha^{-1} wood ash is recommended for maximum production of cucumber in Owerri, southeastern Nigeria, since it improved vegetative growth and yield.

REFERENCE

Adetula O, **Denton** L, **2003**. Performance of vegetative and yield accessions of cucumber (*Cucumis sativa* L.). Horticultural Society of Nigeria (HORTSON) proceedings of 21st annual Conference 10-13 Nov, 2003.

Akande MO, Oluwatoyinbo FI, Makinde EA, Adepoju AS, Adepoju IS, **2010**. Response to Okra organic and inorganic fertilization. Nat Sci. 8(11): 261-266.

Ano AO, **Agwu** JA, **2006**. Effect of animal manures on selected soil properties: 11 nitrogen, potassium and phosphorous. Nig J Soil Sci, 16: 145-150.

Awodun MA, Ojeniyi SO, Adeboye A, Odedina SA, **2007**. Effect of Oil palm Bunch Refuse Ash on Soil and Plant Nutrient Composition and yield of maize. Am Eurasian J Sustain Agric, 1(1): 50-54.

Bougnom BP, Mair J, Efoa FX, Insm H, **2009**. Compost with wood ash addition: A risk or a chance for ameliorating acid tropical soils. Geoderma, 153: 402-407.

Brady NC, **Weil** RR, **2004**. Elements of the nature and properties of soils. Pearson Education, Inc. Upper Saddle River Nigeria.

Demeyer A, Voundi NJC, Verloo MG, **2001**. Characteristics of wood ash and influence on soil properties and nutrient uptake: An overview. Bioresour Technol, 77(3): 287-295.

Duke J, **2000**. The green pharmacy. St Martins press, New York.

Eifediyi EK, **Remison** SU, **2010**. growth and yield of cucumber (Cucumissativum L.) as influenced by farmyard manure and inorganic fertilizer. J Plant Breed Crop Sci, 2(7): 216-220.

Fagimi AA, **Obebode** CA, **2007**. Effect of poultry manure on Pepper Veinal Mottle Virus (PVMV), yield and agronomic parameters of pepper (Capsicum annum) in Nigeria. East Africa J Sci, 1(2), 104-111.

Genstat, **2007**. Genstat for Windows. Release 7.2DE Discovery Edition 3. Lawes Agricultural Trust (Rothamsted Experimental Station). VSN International Ltd., Hemel Hempstead, UK.

Ibeawuchi II, Opara FA, Tom CT, Obiefuna JC, **2007**. Graded replacement of inorganic with organic manure for sustainable maize production in Owerri Imo State, Nigeria. Life Sci J, 4(2): 82-87. (ISSA: 1097-8135).

Mangila E, Tabiliran FP, Naguit MRA, Malate R, **2007**. Effects of Organic Fertilizer on the yield of watermelon. Threshold 2. January - December, 2007, pp 27-35.

Obi IU, **2002**. Statistical method of detecting differences between treatment means, SNAAP Press Ltd. Enugu, 45pp.

Okonmah LU, **2011**. Effects of different types of staking and their cost effectiveness on the growth, yield and yield component of cucumber (*cucumis sativa* L.). Int J Agric Sci, 1(5): 290-295.

Onyia VN, Emarwudia TS, Mbuka CO, Onyishi GC, **2012**. Inter relationship between yield and yield components in cucumber in Enugu, south eastern Nigeria. Afr J Agric Res, 7(25): 3781-3785.

Rodriguez L, Salazar P, Preston TR, **2009**. Effect of biochar and biodigester influence on growth of maize in acid soils. Livest Res Rural Dev, 21(7). http://www.irrd.org/irrd21/7/rodr2/110.htm.

Saarsalmi A, Malkonen E, Piirainen S, **2001**. Effects of wood ash fertilization of forest soil chemical properties. Silva Fennica 35(3): 355-368.

Senjobi BA, Peluole CO, Senjobi CT, Lawal IO, Aride OT, Salami BT, **2010**. Performance of CochorusOlitorius as influenced by soil type and organic manure amendments in Yewa North Local Government Area, Ogun State. Afr J Biotechnol, 9(33): 5309-5312.

Vimala P, Ting CC, Salbiah H, Ibrahim B, Ismail L, **1999**. Biomass production and nutrient yields of four green manures and their effects on the yield of cucumber. Journal of Tropical Agric and food science 27: 47-55.

Citation: Emma-Okafor LC, Obijuru EE, Nwokeji IM, Echereobia CO, Okoli NA, 2022. Effect of poultry manure and wood ash on the growth and yield of cucumber (*Cucumis sativum* L.) in Owerri Southeastern Nigeria. Net J Agric Sci, 10(2): 49-53.