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EFFECTS OF POULTRY MANURE ON NUTRIENT UPTAKE OF *Cucurbita moschata* (Duch. *ex* Lam.) Duch. *ex* Poir.

***OKONWU, K. AND MENSAH, S. I.**
Department of Plant Science and Biotechnology,
University of Port Harcourt, Nigeria.
**Corresponding author; Email: okonwuk@yahoo.com*

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ABSTRACT

The effects of poultry manure (pm) on nutrient uptake of Cucurbita moschata (Duch. ex Lam.) Duch. ex Poir. were conducted in the University of Port Harcourt Botanical Garden. Six treatments viz; 0, 100, 200, 300, 400 and 500 kilogram of poultry manure per hectare (kg pm/ha) were used in a randomized complete block design (RCBD) with four replicates. These treatments were applied once to two week-old seedlings of C. moschata using ring method. The effects of these treatments on leaf N, P, K, Ca, Na and Mg concentrations were studied for six weeks. Soil nutrient levels were also monitored for 0 and 6 weeks. The crude protein and chlorophyll contents were also studied. The study showed that poultry manure increased the nutrient contents (N, P, K, Ca, Na and Mg) of C. moschata. The highest uptake of N, K, Na and Mg concentrations were obtained from treatment at 400 kg pm/ha while 300 kg pm/ha gave the highest uptake for Ca and P concentrations. In all cases, the lowest nutrient uptake was recorded in the control. Crude protein and chlorophyll contents were also found to be higher at 400 kg pm/ha treatment. At P<0.05, there were significant difference among treatments. The poultry manure increased the soil nutrient. The study recommends an application rate of 400 kg pm/ha for the cultivation of C. moschata.

Key words: Poultry manure, Nutrient uptake, *Cucurbita moschata*

INTRODUCTION

Three species of the genus *Cucurbita* L. namely: *C. moschata*, *C. maxima*, and *C. pepo* occur in Nigeria and have been described by several authors (Hutchinson and Dalziel, 1954; Purseglove, 1968; Agbagwa and Ndukwu, 2004). *Cucurbita. moschata* commonly known as musk pumpkin belongs to the family Cucurbitaceae and is native to Nigeria. It represents the only source of resistance to certain viral diseases (Grubben *et al.*, 2004). Agbagwa and Ndukwu (2004) recognized and described 3 cultivars of *C. moschata* based on the fruit's morphological characteristics. It is rarely found growing in the wild; however, it occasionally grows as an escape on dumpsites in most parts of Southeastern Nigeria (Okoli, 1984).

Soil productivity and fertility can be maintained by the use of fertilizers. One of the ways of increasing the nutrient status is by boosting the soil nutrient content either with the use of organic materials such as poultry manure, animal waste, and use of compost or with the use of inorganic fertilizers (Dauda *et al.*, 2005). Apart from giving plant nutrients, both types of fertilizer also improve soils by releasing plant nutrients, improving pH value and increasing microbe (Tisdale *et al*., 1985; Fuangchan, 1995). Applications of organic manures sustain

cropping systems through better nutrient recycling (El – Shakweer *et al.*, 1998).

The need to use renewable forms of energy and reduce costs of inorganic fertilizer has revived the use of organic fertilizers worldwide. Improvement of environmental conditions and public health are important reasons for advocating increased use of organic materials (Seifritz, 1982; Ojeniyi, 2000; Maritus and Vlelc, 2001). Organic manure release nutrients rather slowly and steadily over a longer period and also improves soil fertility status by activating soil microbial biomass (Ayuso *et al*., 1996; Belay *et al*., 2001). They thus, ensure a longer residual effect (Sherma and Mittra, 1991), support better root development and this leads to higher crop yields (Abou el Magd *et al*., 2005). More information about this manure is needed by farmers. The study, therefore, seeks to determine the effects of poultry manure application on the nutrient uptake of *C. moschata.*

MATERIALS AND METHODS

The mature fruits of pumpkin, *C. moschata* used for this study were harvested from a subsistent farm in Abiriba, Abia State. The seeds were removed from the fruits, air dried and stored at room temperature. Poultry manure was collected from the poultry farm of the University of Port Harcourt. The field experiment was conducted at the University of Port Harcourt Botanical Garden. Thirty seeds of *C. moschata* were raised in thirty nursery bags. The planting was done during the raining season in the month of May. Poultry manure (pm) was used as treatment. The treatments were 0, 100, 200, 300, 400 and 500 kg pm/ha. The experiment was laid out in a Randomized Complete Block Design (RCBD). The treatments were applied once to two week-old seedlings (stage III, establishment of a green autotrophic seedling) of *C. moschata* using ring method. Each treatment was replicated four times. The plants were staked to avoid creeping on the ground.

Analysis of soil and poultry manure:

Soil samples and poultry manure were air dried and analysed for organic matter and organic carbon by ash method (AOAC, 1990), total N by micro-Kjeldahl approach and total phosphate by ascorbic acid method (AOAC, 1990). The exchangeable cations K, Na, Mg and Ca were also determined by atomic absorption spectrometry (AOAC, 1990). The nutrients levels (N, P, K, Ca, Na and Mg) of the soil were monitored for 0 and 6 weeks after planting (WAP).

Analysis of plant material:

At 6 weeks after planting (WAP), leaf samples were collected, oven-dried at 80 ^{o}C for 48 hours and grounded. The samples were digested and analysed for total N, P, K, Ca, Na and Mg as described by Okalebo *et al.* (2002). The crude protein was determined by multiplying total N by a factor of 6.25. The chlorophyll content was measured according to the method described by AOAC (1990). Nutrient uptake (N, P, K, Ca, Na, and Mg) was then calculated by multiplying the leaf dry matter and the composition of the nutrients in the leaves.

Statistical analysis:

Statistical analyses of data obtained from plant material and soil samples were by Analysis of Variance (ANOVA) using 5 % level of significance. The statistical package used was SPSS 17.3. Means were compared using Duncan's Multiple Range Tests (DMRT).

RESULTS AND DISCUSSION

Effect of poultry manure on the soil composition:

The initial chemical compositions of the poultry manure and soil used in this study are presented

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in Table I. The poultry manure used was generally high in the major nutrients (N, P and K). The soil was loamy. The organic carbon, total nitrogen and available phosphorus contents of the soil were quite high when compared with the work of Pagel *et al*., 1982. The initial nutrient levels of the soil increased 6 weeks after planting (Table II). This result confirms the report of Sharma and Mittra (1991) which states that nutrients contained in organic manures are released more slowly and are stored for a longer time in the soil, thereby ensuring a long residual effect. Abou El-Magd *et al*., (2005) also reported that poultry manure application supports better root development, leading to higher crop yields. The poultry manure had properties consistent with those poultry manures from other farms (Mitchell and Donald, 1995).

Table I: Initial chemical properties of soil and poultry manure

Chemical properties	Soil	Poultry manure
Na (mg/kg)	206 .00	2095.28
K (mg/kg)	219.20	26,666.00
Ca (mg/kg)	13.20	7539.55
Mg (mg/kg)	95.75	843.15
Total phosphate (mg/kg)	4.95	52.80
Total nitrogen (%)	0.22	0.21
Organic matter (%)	8.20	81.82
Organic carbon (%)	4.77	47.56
Ash content (%)	91.80	18.20
pH	5.94	

Table II: Effect of poultry manure on soil nutrient composition 6 weeks after planting

Treatments (kg pm/ha)	N (g/100g)	P (mg/kg)	K (mg/kg)	Ca (mg/kg)	Na (mg/kg)	Mg (mg/kg)	OM (g/100g)	OC (g/100g)
0	0.147^{e}	4.125^{e}	181.95^{f}	17.15^{f}	158.05^{e}	84.25^{f}	16.20^{a}	9.42^{a}
100	0.210^{d}	4.950^{d}	238.60^{e}	104.60^{e}	221.95^{c}	113.60^{e}	7.00^{d}	4.07^{d}
200	0.224^{c}	12.375^{bc}	353.80^{c}	550.50^{c}	247.20^{b}	262.50^{d}	5.80^{e}	3.37^{e}
300	0.224^{c}	11.963^{c}	412.30^{b}	688.70^{b}	249.00^{a}	277.00^{c}	6.90^{d}	4.01^{d}
400	0.259^{b}	16.500^{a}	317.50^{d}	949.35^{a}	189.40^{d}	423.25^{a}	12.30^{b}	7.15^{b}
500	0.665^{a}	1.240^{f}	467.70^{a}	519.30^{d}	157.25^{f}	296.40^{b}	10.10^{c}	5.87^{c}

Values followed by the same letter(s) in a column are not significantly different at P=0.0 5 (DMRT).

Effect of poultry manure on the nutrient content of *C. moschata:*

N and K uptake:

The uptake of N and K were significantly influenced by doses of poultry manures (Table III). The highest N and K uptake (999.999 and 1317.819 mg/plant respectively) recorded was at 400 kg pm/ha while the lowest uptake (65.436 and 36.398 mg/plant respectively) occurred in the control (0 kg pm/ha). At $P < 0.05$, there were significant differences among these treatments. These results could be due to immobilization of nitrogen and its gradual release by microorganism. Similar result was also obtained by Sengar *et al.* (2000). They reported that N, P, K uptake by rice was significantly increased by the application of manure. This is in conformity with the earlier report by Awodun *et al.*, (2007) and Agbede *et al*., (2008). The amendment of residues with animal manures should have enhanced decomposition and release of nutrients from the plant residues due to lower C:N of the animal manures (MoyinJesu and Ojeniyi, 2000). The total nitrogen level in the soil increased at the point of application of poultry manure treatments and later decreased in the course of the experiment, which might indicate its utilization by *C. moschata*. Benefits which should be expected as a result of addition of organic matter to soil include increase in porosity, infiltration rate and water retention capacity as well as reduction in soil bulk density (Kingery *et al*., 1993; Agbede *et al*., 2008).

Mg and Na uptake:

Magnesium and sodium uptake of *C. moschata* were significantly influenced by treatments (Table III). Among treatments, the highest Mg and Na uptake (33.461 and 129.552 mg/plant respectively) were recorded from the treatment at 400 kg pm/ha which was significantly different from other treatments. In the treatments, the lowest amount of Mg and Na uptake (1.300 and 1.300 mg/plant respectively) was observed in the control (0 kg pm/ha). It is implied that increases in plant nutrients content is attributed to release of nutrients from the poultry manure. Earlier studies by Ojeniyi and Adegboyega (2003) found that goat dung (GD) increased leaf N, P, K, Ca and Mg contents of *Celosia.* Also Smith and Ayenigbara (2001) found that GD increased leaf N, K and Ca status of Indian spinach. These results could be attributed to availability of nutrient in soil observed for PD treatments that led to increased Na, K, Ca and Mg as indicated by leaf analysis. This is consistent with the report of Awodun *et al*., (2007) and Agbede *et al*., (2008).

Ca and P uptake:

The uptake of Ca and P were significantly influenced by doses of poultry manures (Table III). The highest Ca and P uptake (288.822 and 1.782 mg/plant respectively) recorded was at 300 kg pm/ha while the lowest uptake (14.301 and 0.064 mg/plant respectively) occurred in the control (0 kg pm/ha). At $P < 0.05$, there were significant differences among these treatments. This finding is at par with Iftikhar and Qasim (2003) that showed that poultry manure increased total available N, P and K contents. Blum *et al*. (2003) found sufficient quantity of essential nutrients in poultry manure.

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Table III: Effect of PM treatments on some mineral nutrient content of *C. moschata*

Treatment (kg pm/ha)	Nutrient uptake (mg/plant)					
	N	P	K	Ca	Mg	Na
0	65.436^{f}	0.064^{e}	36.398^{f}	14.301^{f}	1.300^{f}	1.300^{f}
100	277.536^{d}	0.460^{d}	297.566^{e}	70.991^{d}	7.210^{e}	6.317^{e}
200	263.144^{e}	0.461^{d}	361.115^{d}	58.212^{e}	8.476^{d}	7.775^{d}
300	889.595^{b}	1.782^{a}	1212.990^{b}	288.822^{a}	31.135^{b}	20.871^{b}
400	1000.000^{a}	0.669^{c}	1317.817^{a}	119.565^{c}	33.461^{a}	129.552^{a}
500	594.300^{c}	1.051^{b}	998.982^{c}	134.574^{b}	23.834^{c}	17.405^{c}
SE	0.81650	0.00082	0.00342	0.81650	0.08165	0.08165
SD	3.4641	0.00348	0.01451	3.4641	0.34641	0.34641

Values followed by the same letter(s) in a column are not significantly different at P=0.0 5 (DMRT).

Crude protein and chlorophyll content:

The results of the treatments indicated that 400 kg pm/ha treatment gave the highest mean level for crude protein, chlorophyll a, chlorophyll b and total chlorophyll while 0 kg pm/ha gave the lowest mean values for the treatments. The Table IV revealed that the photosynthetic pigments increased gradually during plant age in both control and treated plants. However, total chlorophyll in *C. moschata* leaves as well as crude protein were in harmony growth parameters due to poultry manure. This is reasonable since chlorophylls activity depends on growth status. The magnitude of increase chlorophyll a, b and total chlorophyll were more pronounced with poultry manure applied at 400 kg pm/ha. Boateng *et al* (2006) reported that the poultry manure at 4 t/ha has the potential to improve maize yields significantly over control. The treatments had significant effect on the crude protein and chlorophyll contents at $P < 0.05$. Dixit and Gupta (2000) reported that farm yard manure or biofertilizer either alone or in combination showed an increasing tendency of protein content in rice grain.

Table IV: Effect of PM on the crude protein and chlorophyll content of *C. moschata*

Treatment (kg pm/ha)	Chlorophyll a (mg/l)	Chlorophyll b (mg/l)	Total Chlorophyll (mg/l)	Crude protein (g/plant)
0	8.39^{b}	3.70^{b}	17.86^{b}	0.409^{f}
100	4.53^{e}	2.21^{e}	8.12^{f}	1.735^{d}
200	4.41^{f}	1.61^{f}	9.28^{e}	1.645^{e}
300	6.70^{d}	2.80^{c}	14.42^{c}	5.559^{b}
400	11.63^{a}	5.11^{a}	24.38^{a}	6.251^{a}
500	6.75^{c}	2.54^{d}	14.18^{d}	3.716^{c}
SE	0.01599	0.05344	0.01700	0.00817
SD	0.06784	0.22672	0.07212	0.03466

Values followed by the same letter(s) in a column are not significantly different at P=0.0 5 (DMRT).

Conclusion:

The study indicates that poultry manure is a valuable material in the production of *C. moschata* whose nutritious vegetable use needs to be encouraged. An application rate of 400 kg pm/ha was capable of increasing nutrient content by more than 100% over the control. The 400 kg pm/ha may be recommended for now since it produced high chlorophyll and crude protein contents which is a function of nitrogen. It may be worthwhile considering point application of poultry manure as is done with inorganic fertilizers in order to minimize manure wastage. The use of poultry droppings is therefore recommended for the cultivation of *C. moschata*.

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