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Short Communications

EFFECT OF DIFFERENT RATES OF POULTRY MANURE ON GROWTH AND YIELD OF CUCUMBER (*Cucumis sativum*) IN IWOLLO, SOUTHEASTERN NIGERIA

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ABSTRACT

Information on optimum rates of poultry manure is very important in the correction of soil nutrient deficiencies for crop production. A study was carried in the field to establish optimum rates of poultry manure for cucumber (Cucumis sativum) production. The investigation took place at the Teaching and Research Farm of Department of Agricultural Technology, Enugu State Polytechnic, Iwollo, southeastern Nigeria. The treatments were; four levels of poultry manure (10, 20, 30, 40 t ha^{-1}) and no poultry manure (control), laid out in a randomized complete block design with three replications. The parameters measured were; seedling emergence, vine length at 30 and 60 days after planting (DAP), number of leaves per plant at 30 and 60 DAP, days to 50% flowering, number of fruits plot^{-1} and fruit yield. The results indicated that growth, yield and yield components of cucumber increased significantly ($p < 0.01$) with various rates of poultry manure over control. Seedling emergence was not significantly influenced by application of poultry manure. However, significantly longest vine length at 30 (59.8 cm) and 60 (68.9 cm) days after planting, number of leaves per plant at 30 (253) and 60 (254) days after planting, number of fruits plot^{-1} (106) and fruit yield (5.2 tha^{-1}) were obtained where poultry manure was applied at 40 t ha^{-1}. Number of days to 50% flowering (30) was significantly ($p < 0.05$) lower in 40 t ha^{-1} poultry manure treated plots. The overall response of cucumber crop was significantly higher by the application of poultry manure at 40 t ha^{-1} to the soil.

Key words: Poultry manure, cucumber, poinsett, yields, Iwollo

INTRODUCTION

Cucumber (*Cucumis sativus*), a monoecious annual crop in the Cucurbitaceae family has been cultivated by man for over 3,000 years (Adetula and Denton, 2003; Okonmah, 2011). It originated in southern Asia but a large number of cultivars have been developed and are grown worldwide. The vegetable crop is a creeping vine, which bears cylindrical fruits used as culinary vegetables cherished by man and eaten in salads or sliced into stew in tropical regions. Cucumbers constitute about 95% water, keeping the body hydrated while helping the body eliminates toxins. It has most of the vitamins the body needs in a single day and used as a source of silicon for treating skin irritations and sunburn (Duke, 1997), aids in weight loss and digestion, cures diabetes, reduces cholesterol and controls blood pressure.

In spite of the increasing relevance of cucumber in Nigeria, production is not increasing correspondingly. Increase in cucumber production can be achieved either by putting more land area under its cultivation or by using improved varieties with appropriate cultural practices. Application of either organic or mineral fertilizer has been found to be one of the quickest and easiest strategies for increasing the yield of cucumber per unit area (Nweke *et al.*, 2014; Nweke and Nsoanya, 2015). Poultry manure is an excellent organic fertilizer as it contains about 3.5% nitrogen, 1.5-3.5% phosphorus, 1.5-3.0% potassium and many micronutrients (Mohammed *et al.*, 2010). Unlike mineral fertilizer, it adds organic matter to soil, which improves soil structure, nutrient retention, aeration, soil moisture holding capacity and water infiltration (Deksissa *et al*., 2008). Poultry manure more readily supplies P to plants than other organic manure sources (Garg and Bahla, 2008) and contains essential nutrient elements associated with high photosynthetic activities and thus promotes root and vegetable growth (John *et al.*, 2004).

A study by Enujeke (2013) indicated that a variety of cucumber (Market more) that received the highest rate of poultry manure (20 t ha^{-1}) was superior with respect to vine length, number of leaves, fruit diameter, fruit length and fruit weight at 4, 6 and 8 weeks after planting for two years. Based on the findings of the study, farmers in the study area were advised to apply 20 t ha^{-1} of poultry manure for increased growth and yield of cucumber. Abayomi (2008) observed differential crop genotype response to fertilizer application which was in line with Lower and Edwards (1986) who reported similar observation for different

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cucumber varieties. This may have significant practice implications for field production of cucumber. Information on the potential growth and yield response of poultry manure rates above 20 t ha^{-1} and for varieties like commonly grown variety (poinsett) have not been evaluated. This study was therefore designed to evaluate the growth and yield responses of cucumber variety (*Poinsett*) to different rates of poultry manure under field condition in Iwollo, southeastern Nigeria.

MATERIALS AND METHODS

The study was conducted at the Teaching/Research Farm of Department of Agricultural Technology, Enugu State Polytechnic, Iwollo (06º 26.35′ N and 07º 16.83′E), Southeastern Nigeria. The area has an annual rainfall of 1700-1800 mm. Before treatment application, soil and poultry manure samples were collected and analyzed for physciochemical properties using standard laboratory methods. A total land area of 176 m^2 (22 m × 8 m) was cleared manually and demarcated into three blocks. Each block consisted of five plots, measuring 4 m × 2 m (8 m^2) with 0.5-m alleys between plots and 1m alley between blocks. Dried poultry manure from the Polytechnic poultry farm was applied to the respective plots at 0, 10, 20, 30 and 40 t ha^{-1} and incorporated into the soil two weeks before sowing. Cucumber seeds were sown at a spacing of 1 m × 1 m at two seeds per hole which was later thinned to one per stand 2 weeks after emergence. Weeding was done manually by hand pulling.

The percentage (%) emergences of cucumber seedlings were determined at 14 days after planting (DAP) on five randomly selected plants from each plot. Growth parameters (vine length, number of leaves per plant, days to 50% flowering) were assessed at 30 and 60 DAP. Cucumber vine length was measured by using a flexible measuring tape. Number of leaves was assessed by counting the leaves. At every harvest the number of fruits per plot was counted before the fruits were weighed using a 10-kg scale. The cumulative weights of the entire harvests (10 times) were summed up. The entire data were subjected to an Analysis of Variance (ANOVA) test based on the Randomized Complete Block Design (RCBD) according to the procedure outlined by Steel and Torrie (1980). Statistically, significant difference among treatment means was estimated using the Fisher's Least Significant Difference (F-LSD) at 5% level.

RESULTS AND DISCUSSION

Analysis of initial soil properties prior to treatment application indicate that the soil used for this experiment was sandy loam in texture, slightly acidic (pH value 4.8) and deficient in N, P and K (Table 1). The poultry manure was however, rich in N, P, K,Ca and Mg (Table 2).

Percentage emergence and Vine length

The data shown in Table 3 indicates that the application of poultry manure to soil did not significantly influence the cucumber seedling emergence. However, it increased the plant vine length significantly ($p < 0.05$) over the control at 30 and 60 days after planting (DAP). The longest vine length at 30 DAP (59.8 cm) and 60 DAP (68.9 cm) was obtained from the treatment getting 40 t ha^{-1}poultry manure. Shortest vine length (7.3 cm) and 15.6 cm at 30 and 60 DAP, respectively was obtained from the control. The vine length increased with increase in poultry manure rate.

Table 3 also shows that the application of poultry manure significantly ($p < 0.05$) increased the number of leaves per plant over the control. The highest number of leaves per plant at 30 (253) and 60 (254) DAP was obtained from plots amended with 40 t ha^{-1}, followed by 231 and 248 from those

Table 1: Initial soil physicochemical properties

Soil properties	Unit	Test value
Bulk density	g cm^{-3}	1.98
Textural class		Sandy loam
pH (1:1 H_2O)		5.30
Organic carbon	%	2.80
Total Nitrogen	%	0.049
Available P	mg kg^{-1}	1.46
CEC	cmol kg^{-1}	8.8
Ca^{2+}	cmol kg^{-1}	8.40
Mg^{2+}	cmol kg^{-1}	3.9
K^{+}	cmol kg^{-1}	0.35
Na^{+}	cmol kg^{-1}	1.94

Table 2: Chemical properties of poultry manure

Properties	Units	Poultry manure
pH (H_20)		7.8
Organic carbon	%	43.1
Organic matter	%	74.3
Nitrogen	%	4.15
C:N		4.10
Phosphorus	mg kg^{-1}	8.32
Potassium	cmol kg^{-1}	1.70
Calcium	cmol kg^{-1}	4.01
Magnesium	cmol kg^{-1}	6.77
Soluble sodium	cmol kg^{-1}	1.20

Table 3: Mean effect of different rates of poultry manure on the growth/agronomic parameters of cucumber (*Cucumissativum*) in Iwollo

Treatment (t ha^{-1})	Percentage Emergence	Vine Length (cm) 30DAP	Vine Length (cm) 60DAP	Number of Leaves/plant 30DAP	Number of Leaves/plant 60 DAP	Days to 50% Flowering
0	78.8	7.3	15.6	112	122	48
10	78.6	27.6	38.5	124	128	46
20	94.0	43.6	53.1	131	135	36
30	73.8	46.6	60.4	231	248	34
40	83.3	59.8	68.9	253	254	30
F-$LSD_{(0.05)}$	NS	0.26	3.12	2.055	2.15	2.83

amended with 30 t ha^{-1}. Highest number of days to 50% flowering of 48 days recorded in the control did not differ significantly from the treatments receiving 10 t ha^{-1} poultry manure. Least number of days to 50% flowering was obtained from the treatment receiving 40 t ha^{-1} poultry manure. It can be concluded from the results that this increase in vine length and number of leaves per plant is due to the improvement in the nutrient status and physicochemical properties of the soil. This is in support of the observation made by Henry (2000) that the beneficial effects of organic matter in unfertile soils consist of supplying lots of nitrogen and sulphur which improves the quality of leaves.

The data in Table 4 show that poultry manure application caused significant ($p < 0.05$) changes in the number of fruits plot^{-1} over the control. The highest number of fruits plot^{-1} (106) was recorded in the plot amended with 40 t ha^{-1} poultry manure, followed by 101.3 from the plot receiving poultry manure at the rate of 30 t ha^{-1}, both of which are statistically at par with each other. The lowest value of 30.6 fruits plot^{-1} was recorded in the control. Table 4 also shows that there was a significant ($p < 0.01$) increase in the fruit yield of cucumber per hectare with increasing doses of poultry manure over the control. The highest fruit yield of 11.15 t ha^{-1} was found in the treatment receiving 40 t ha^{-1} followed by 8.76 t ha^{-1} fruits recorded in the treatment receiving 30 t ha^{-1} poultry manure. It was obvious from the data that all of the plots getting different rates of poultry manure are significantly superior to the unamended control. The superiority in fruit yield of cucumber based on the rate of application of poultry manure was 40 > 30 > 20 > 10 > 0 t ha^{-1}. The poultry manure applied at 40 t ha^{-1} was just enough to satisfy the nutritional requirements of cucumber plant. This was evident in the significant yield experienced in the treatment over the other treatments. The fruit yield was, however, far below mean fruit weight of 49.3 t ha^{-1} obtained from applying 20 t ha^{-1} poultry manure in growing money maker variety (Enujeke, 2013). This indicates that the magnitude of response of cucumber to application of poultry manure may be genotypic responsive. It is also lower than the mean yield of 43,259 kg ha^{-1} obtained with 10 t ha^{-1} farmyard manure and 400 kg ha^{-1} of fertilizer which were 166.42% higher than the control (Eifediyi and Remison, 2010).

Table 4: Effect of different rates of poultry manure on the yield indices of cucumber in Iwollo

Treatment (t ha^{-1})	Number of fruits plot^{-1}	Weight of fruits (kg plot^{-1})	Weight of fruits (t ha^{-1})
0	30.6	2.64	3.30
10	59.6	3.27	4.09
20	98.3	4.56	5.70
30	101.3	7.02	8.76
40	106	8.92	11.15
F-LSD$_{0.05}$	5.34	0.89	0.632

These results support earlier findings by Tindall (2000) that cucumber could thrive well on a wide range of soil conditions but would however; do preferably better on fertile soils with good moisture retaining capacity. The findings agree with Tiarks *et al.* (1974) that soil organic matter content increased linearly with the amount of manure applied. This work suggests that the significant increase in the number of cucumber fruits could be attributed to improvement in soil physical and chemical properties and abundance of different nutrients depending on the addition of poultry manure. The significant increase in fruit yield of cucumber may have been possible due to the availability of better nutrients and improved development of the plants, along with greater proliferation of leaves due to the favorable effects of poultry manure on soil physical characteristics. To obtain a greater fruit yield, it is important that farmers should amend their soils with enough poultry manure (> 30 t ha^{-1}) to increase the nutrient level of the soil especially when the soil is of low fertility as was the case in the study area.

CONCLUSION

Poultry manure is generally considered a waste product; however, the present findings indicate its positive influence on most of the yield parameters of cucumber crop in response to its favourable effects on soil properties. Use of poultry manure as organic fertilizer can save the cost of mineral fertilizer and minimize environmental pollution. By comparing the levels of poultry manure application, 40 t ha^{-1} was found to be the optimal dose regarding important yield parameters, such as vine length, number of leaves per plant, number of fruits per plot, and the fruit yield of cucumber crop (Poinsett var.) in Iwollo, southeastern Nigeria.

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