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INVESTIGATION ON IMPACTS OF POULTRY MANURE APPLICATION ON YIELD, DISEASE INCIDENCE AND SEVERITY OF CUCUMBER (*CUCUMIS. SATIVUS L.*) IN AWKA, ANAMBRA STATE, NIGERIA

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ABSTRCT

An experiment was carried out at the Teaching and Research Farm of Crop Science and Horticulture, Nnamdi Azikiwe University Awka, Anambra State, to determine the effects of different poultry manure rates on the growth, yield, disease incidence and severity of one variety of cucumber (*Cucumis. sativus L.*). The experimental site was cleared and the beds were made. Plot size was 3 m×1.5 m, while distance between each bed was 1m. The treatments comprised cucumber '999' which received four poultry manure rates (0 tons/ha, 5 tons/ha, 10 tons/ha and 15tons/ha). The experiment was laid out in a 1×4 factorial in Randomised Complete Block Design in four replicates. Data collected included plant height, vine length, leaf area per plant, number of flowers per plant, number of fruits per plant, fruit length, fruit circumference, fruit weight, yield per hectare, disease incidence and severity. Results showed that poultry manure significantly increased growth and yield of cucumber plants, with 15 tons/ha giving the highest yield (20,183 ton/ha) followed by 10 tons/ha which produced 15,422 ton/ha, while the least was zero application which gave 9,789 tons /ha. Manure rates did not significantly affect some growth and yield attributes such as plant height, number of leaves, number of flowers and fruit circumference especially during the first two weeks after planting. Increased poultry manure rates led to increased incidence of *Fusarium* wilt of cucumber but this did not affect yield. Poultry manure rate of 15 tons/ha could be recommended for farmers in the study area for increased growth and yield of cucumber plants.

Keywords: Cucumber; poultry manure; growth parameters; yield; disease incidence; severity.
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INTRODUCTION

Cucumber (*Cucumis sativus L.*) is the fourth most important vegetable crop after tomato, cabbage and onion (Eifediyi and Remison, 2010). Although its calorie and nutritional value are very low but it is a primary source of vitamins and minerals in the human diet (Mah, 1989). In addition to its delicious taste, it has high medicinal value. It is well known for natural diuretic and can, therefore, serve as an active drug for secreting and promoting the flow of urine. Due to a high content of potassium (50-80 mg/100 g), cucumber can highly be useful for both high and low blood pressures (Kashif *et al*., 2008).

There exist three main varieties of cucumber: slicing, pickling and burpless. Within these varieties, several different cultivars have emerged. Many cultivars of cucumber exist with varying shapes, skin colours and carotene contents (Simon, 1992). Cucumber cultivars have distinctive characteristics which make them suitable for particular environment or condition in terms of tolerance to drought, disease resistance, early maturing and yield (Hamid *et al* ., 2002). *Cucumis sativus* is a day-neutral, annual, climbing, herbaceous plant, with a strongly

developed tap root. The stem is stout, simple 4 angled with hairy tendrils. The leaves are triangular or ovate in shape 7-20 cm in length, base deeply cordate, apex of acuminate and petiole 5-15 cm in length (Tindal, 1983; Rogg.*et al.,* 2001).

One of the abiotic challenges facing cucumber production in the tropics is the inherent low concentration of essential nutrients in the soil for crop growth and development (Jitendra *et al*., 2013). These nutrients can be provided to the soil through the use of fertilizers. Fertilizer can be in organic or inorganic form. The use of inorganic fertilizers has not been helpful as it is associated with increased soil acidity, leaching and nutrient imbalance (Jitendra *et al*., 2013).

Organic manure is a sustainable source of nutrient and reduces the expenses of inorganic fertilizer for crops (Ayoola and Adediran, 2006). Large quantities of manure, up to 175 t/ha on poor soil, are often used (Hemphill, 2010). Applying manure about two weeks before planting of crops helps increase nutrient availability especially in high rainfall areas and on porous soils; therefore, having rapid percolation is assured and in return improved plant vegetative and reproductive parameters (Sanni *et al.,* 2015).

Disease incidence refers to the number of plant entities which are visually diseased out of the total number of plant units observed (Campbell and Madden, 1990). Another definition of disease incidence is the proportion (0 to 1) or percentage (0 to 100) of diseased entities within a sampling unit (Seem, 1984). Naturally, disease incidence is not normally distributed (Madden and Hughes, 1995; Garrett *et al*., 2004). Disease incidence is a binary variable because each observed individual plant is either visibly affected or not, or damage symptoms are present or absent (Madden, 2002). Disease incidence assesses the probability (π) of a plant or other plant entity being diseased. This probability is clearly a function of the pathogen, host and environment. The probability of plant not being diseased is 1- π. Disease assessment or phytopathometry usually involves the measurement and quantification of plant disease. Therefore, it is a primary significance in the study and analysis of plant disease epidemics (Nutter *et al*., 2006). Whether or not disease incidence or severity or both should be measured will depend on the disease, the particular epidemiological circumstances and the reason for undertaking the disease assessment. With systemic diseases (e.g. many virus diseases) or root diseases (e.g. phytophthora root rots) that infect and kill whole plants or when the disease causes similar amounts of damage on plants within a crop, the disease incidence, expressed as the percentage of plants showing symptoms or damage, may suffice.

Determining disease severity often requires estimating the proportion of the total photosynthetic area of the crop that is diseased which is often called the proportion of leaf area affected. This measurement is much less precise and less controllable than measurements based on counting individual plants. Disease severity assessment relies on visual judgments which tend to be deceptive and to vary greatly from person to person (Nutter *et al*., State Objective of Study 2006).

MATERIALS AND METHODS

The experiment was carried out at the Teaching and Research Farm of Department of Crop Science and Horticulture in the Faculty of Agriculture, Nnamdi Azikiwe University Awka, Anambra State, from May to June 2018 cropping season to determine the effects of different poultry manure rates on the growth, yield, disease incidence and severity of *Cucumis sativus*. Awka is located in the tropical rain forest zone of Nigeria with average temperatures of 27^0C, annual rainfall of 1828 mm. The farm lies on latitude 6.2497' N and longitude 7.1167'E.

The experimental site was slashed and tilled, after which the beds were made. The net plot size was 3 m×1.5 m, the distance between each bed was 1 m, giving a total land area of 17 m×11 m.

The treatments comprised one cucumber variety: 999 which received four poultry manure rates (0, 5, 10,15 tons/ha). The experiment was laid out in a 1×4 factorial in Randomised Complete Block Design (RCBD) and replicated four times, to give 16 treatment combinations. Poultry manure was incorporated into the bed at the rate of 0, 5, 10, 15 tons/ha which was converted to kilogram and allowed to cure for 2 weeks. Sowing was done manually on the top of the beds on May 5, 2018.

The seed rate was 2 seeds per hole with a plant spacing of 50 cm×50 cm. Weeding was done manually three times during the growing period at two-week intervals. Data collected included plant height, vine length, number of leaves per plant, leaf area per plant, number of flowers per plant, number of fruits per plant, fruit length, fruit circumference, fruit weight, yield per hectare, disease incidence and severity.

Assessment of disease incidence and severity

Disease incidence was assessed by visual observation of plants in the field. The percentage disease incidence of cucumber was determined according to Snedecor and Cochran (1994) as follows:

$$\text{Disease incidence} = \frac{\text{Number of diseased plants}}{\text{Total number of plants sampled}} \times \frac{100}{1}$$

The disease severity was assessed by recording the extent or degree of the disease in the infected cucumber plants in the sampled plots. A five-point scale of 0-5 was used (IRRI, 2006)

Where,

0 = No infection
1 = 1- 20% of plants infected
2 = 21-40% of plants infected
3 = 41-60% of plants infected
4 = 61-80% of plants infected
5 = 81-100% of plants infected

Laboratory Analysis of the Infected Plant Parts

The specimens were collected by random sampling of infected plant parts from the experimental farm. Infected plant parts were packaged separately in a brown envelope and taken to the Pathology Laboratory of Department of Crop Science and Horticulture, Nnamdi Azikiwe University, Awka.

The working area was first surface-sterilised using methylated spirit. The infected cucumber vines were washed with tap water and cut into sections with sterilised blade. They were surface-sterilised in 10 ml of ethanol mixed with 90 ml of distilled water for 5 minutes and then rinsed twice in sterile distilled water.

Ten (10) g of PDA was poured into a 250 ml conical flask and 250 ml of distilled water was added, stirred properly, corked and autoclaved at 120^0C at a pressure of 15ps±1, for 20-25 minutes. After the preparation, the PDA was poured into a 9 cm Petri dish with two drops of lactic acid to knock off bacterial growth. The infected cucumber plant parts were plated directly into the PDA medium by placing the cut pieces of the plant on the centre of the Petri dishes. The dishes were each held together using a masking tape. A total of six Petri dishes were used. The dishes were kept on the laboratory benches at a room temperature of 27 ±2^{o}C for four days. Sub-culturing was done severally until a pure culture was obtained. The pure culture was stored properly for subsequent identification and characterisation of the fungus.

Microscopic identification of the fungal organisms

Isolation and characterisation were done with the aid of a compound microscope with a magnification of x100. The identification was done with a temporary slide prepared by placing one drop of water on the surface of the slide. Then a small portion of the culture was collected with the aid of a sterile needle from the interface of the continuous growth and placed on the slide which was covered with a cover slip. The fungus was identified using illustrated pictures of the fungi by Barnet and Hunter (1994). Micrograph of the identified pathogen was taken.

Data collected were subjected to Analysis of Variance (ANOVA) using GENSTAT (2011) statistical software package. Mean separation was done using Least Significant Difference (LSD) at 5% probability level.

RESULTS

Fungi isolated from the cucumber vine in Awka, Anambra State

The results of isolation and identification showed that the fungal organism isolated was *Fusarium oxysporum* (Plate2). Identification was based on the growth characteristics and fruiting bodies and confirmed using *Illustrated Pictures of Fungi* by Barnet and Hunter (1994).

Images of the pure culture and micrograph of *Fusarium oxysporum* isolated from infected cucumber plant materials are as shown in the plates below.

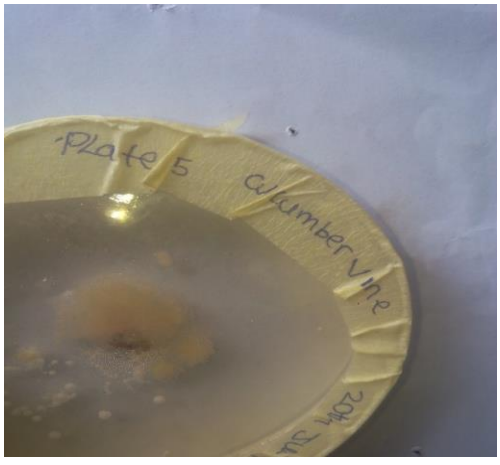

Plate 1: Pure culture of *Fusarium oxysporum*

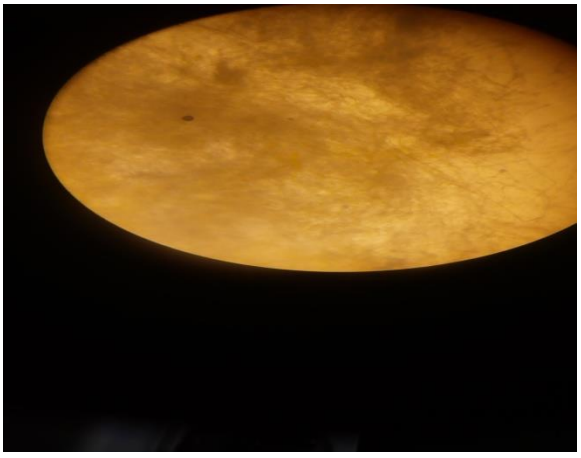

Plate 2: Micrograph of *Fusarium* oxysporum

Effect of poultry manure on disease incidence and severity of cucumber

Table 1 shows that of the poultry manure rates assessed, only the application of 15 tons/ha significantly ($p<0.05$) increased disease incidence on cucumber when compared with the control. Poultry manure application did not have significant ($p>0.05$) effect on disease severity (Table 1).

Table 1 Effect of poultry manure rate on disease incidence and severity on *Cucumber* .plants

Poultry manure (t/ha)	Disease Incidence (%)	Disease severity
0	16.70	1.00
5	20.80	1.00
10	25.00	1.00
15	50.00	1.75
LSD0.05	11.11	NS

NS = Not significant

Effect of poultry manure on growth parameters of cucumber

Table 2 shows that poultry manure application had no significant ($p>0.05$) effect on the number of leaves and vine length of cucumber at two weeks after planting except at four weeks. At four weeks after planting, there was significant ($p<0.05$) difference between the number of leaves of cucumber that received 0 ton/ha of poultry (11.39) and those that received 5 tons/ha (17.80) and 10 tons/ha (17.04), respectively. The longest vine length (74.20 cm) was obtained when 5 tons/ha of poultry manure was applied which was statistically different from vine length obtained when 0 tons/ha (34.00 cm) and 66.00 cm was obtained when 10 tons/ha was applied. Application of poultry manure at 10 tons/ha significantly ($P<0.05$) increased leaf area of cucumber (406.00 cm^2) compared with the control (164.00 cm^2).

Table 2: Effect of poultry manure rate on number of leaves, plant height and leaf area of cucumber plants

	Some Growth Parameters				
PM(t/ha)	NL (2weeks)	PH(2weeks) (cm)	NL(4weeks)	VL(4weeks) (cm)	LA(4weeks) (cm^2)
0	4.03	5.21	11.39	34.00	164.00
5	4.65	6.32	17.80	74.20	265.00
10	4.50	5.57	17.04	66.00	406.00
15	4.62	5.69	14.70	58.60	243.00
LSD0.05	NS	NS	5.085	19.61	230.40

PM= Poultry manure, NL= Number of leaves, PH= Plant height, VL= Vine length, LA = Leaf area, NS= Not Significant.

Effect of poultry manure on yield parameters of cucumber

The result showed that poultry manure application did not significantly ($p>0.05$) influence number of flowers and fruit circumference of cucumber (Table 3). Fruit length of cucumber was similar for all treatments except the application of 15 tons/ha poultry manure application, which resulted in the fruit length that was significantly ($p<0.05$) longer (31.80 cm) than that of the control (24.60 cm) (Table 3).

Fruit weight of cucumber varied significantly ($p<0.05$) with the rate of poultry manure applied (Table 3). Application of 15 tons/ha resulted in the heaviest fruits while the control resulted in the least. Table 3 shows that poultry manure applied at different rates had significant ($p<0.05$) effect on number of fruits, where the highest number of fruits per plant (3.325) was obtained at 15 tons/ha, followed by 2.91 at 10 tons/ha while the least (2.19) was observed at 0 tons/ha (Table 3). Yield of cucumber per plot varied with the rate of poultry manure applied. The control had the lowest yield (9,789 tons/ha) while the application of 15 tons/ha resulted in the highest yield (20,183t/ha) (Table 3).

Table 3: Effect of poultry manure rate on number of flowers, fruit circumference, fruit length, fruit weight, number of fruits and yield per plot of cucumber

	Yield parameters					
PM(t/ha)	NF	FC (cm)	FL (cm)	F wt (kg)	FN	Yield (tons/ha)
0	6.04	17.69	24.60	0.819	2.192	9,789
5	7.08	18.99	28.90	1.186	2.908	14,394
10	6.50	19.28	30.90	1.157	2.792	15,422
15	6.40	18.32	31.80	1.577	3.325	20,183
LSD0.05	NS	NS	6.59	0.304	0.5753	3368.6

PM =Poultry Manure, NF= Number of flowers, FC=Fruit Circumference, FL=Fruit length, FWt = Fruit weight, FN Fruit number, Y/Plot =Yield per plot, NS = Not significant

DISCUSSION

The results showed that increasing poultry manure rates resulted in increased number of leaves, vine length and leave area of cucomber at 4 weeks after planting. Similar results have been reported (Adesina *et al*., 2014; Mangila *et al*., 2007; Enujeke, 2013). Poultry manure improved the vegetative growth of pepper plants probably by enhancing the availability and uptake of nutrients. Adekiya and Ojeniyi (2002) and Ewulo *et al*. (2008) reported that poultry manure was not only a rich source of nutrient but it also helped to make available more essential elements to the plants which were already present in the soil.

Poultry manure rates at 15 tons/ha increased fruit length and fruit number of cucumber compared with the control. Adediran *et al.* (2003) reported that high levels of poultry manure significantly increased fruit length while Shafiee (1996) reported that 30 tons/ha of cow dung resulted in the highest number of cucumber per plant. Agyarko and Asiedu (2012) also reported that fruit size and fruit girth of cucumber were improved with application of poultry manure. The higher number of cucumber fruits with increased rate of poultry manure application may be due to increased branching with more fruiting nodes, which led to more cucumber fruits. Highest poultry manure rate resulted in the highest yield. This may have resulted from the positive impact of poultry manure on soil physical attributes such as soil temperature, water-holding capacity and improvement in the number of soil pores as suggested by Ewulo *et al.* (2008).

The findings revealed that none of the treatments was free from *Fusarium* wilt but that the incidence was highest when poultry manure was applied at 15 tons/ha. This corroborates the findings of Ranjit and Surajit (2013) who reported that late blight disease incidence of tomato increased with increased application of inorganic manure. *Fusarium oxysporum* was identified as the organism isolated from the infected cucumber plant parts, which corroborates the findings of Majdah (2015), who isolated eight species of *Fusarium oxysporum* from wilted *Cucumber* plants in Mekkah, Egypt.

CONCLUSION

The study revealed that compared to the control (0 tons/ha), poultry manure applied at 15 tons/ha significantly increased vine length, leaf area, fruit length, fruit number and fruit yield of cucumber. This was, however, accompanied by increase in incidence of *Fusarium* wilt, which, however, did not cause any appreciable damage.

Therefore, poultry manure rate at 15 tons/ha could be recommended for use by farmers in the study area for increased growth and yield of cucumber plants. The farmers should also treat seeds with fungicides and pesticides to reduce the effect of soil and seed-borne microorganisms that affect establishment of cucumber plants.

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