Effect of soil typeand Chicken Manure on Cucumber (*Cucumis sativus L)* Growth and Yield under GreenhouseConditions

ABSTRACT:

This study was conducted at the greenhouse of the faculty of natural resources and environmental studies, university of kordofan at Elobeid, Sudanduring 2017- 2018to investigate the effect of soil types and chicken manure on cucumber (*Cucumissativus L.*) growth and yield under greenhouse conditions. Randomized complete block design (RCBD) with four replications was used. Clay, Sand and Sandy Clay "Gardud" soils were prepared inside the greenhouse, one dose (5 t/ha) and two doses (10 t/ha) of chicken manure were applied on some plots while other plots were left as control. Some soil physical properties; moisture content, bulk density, porosity and infiltration rate and some chemical properties such as; soil reaction, soluble actions (sodium, potassium, magnesium and calcium), phosphorus and nitrogen were determined before sowing.Results generally showed significant differences among all treatments and their interactions,henceit is recommended that, 10 t/ha chicken manure fertilizer gave the highest values of number of fruits/plant, yield (ton/ha) and yield (kg/plant) compared to other treatments when applied with clay soil under tested condition.

Keywords: chicken manure, Cucumber, Greenhouse, soil type.

1. INTRODUCTION

Cucumber (*Cucumis sativusL.)* is an important vegetable and one of the most popular members of the Cucurbitaceae family, and is an economically important fruit vegetable (Khatiwad and Adhikari, 2020). Cucumber is agriculturally, economically and nutritionally important vegetable crop. The plant is the fourth most important in the World vegetable market after tomato, cabbage andonion.

There are three primary varieties of Cucumber; Slicing, pickling and Burp less (Rajawat*et al.*, 2017). The cucumber is initially from India however is currently grown in most continent.Cucumber is one of our most ancient vegetables. Cave excavations have revealed that cucumber has been grown as a food source for over 3000 years in India and it seems to spread rapidly to Western Asia, and then to Southern Europe (Lv*et al.*, 2012).Cucumber is good for diabetic patients as it contains low sugar and help in the burning of excess fat in the body (Shisode, 2021). Soil typeshave strong effect on vegetablesplant growthhabit and establishment,also soil fertility status is very essential for growth and development for cucumber (Wang, 2021). Other workers found that, Fertile soils significantly affect the quality and yield of the crop as compared to infertile soil, andrich soils with nutritional elements are used for the cultivation of cucumber, on the other hands , infertile soils result in bitter and misshapen fruits which are often rejected by consumers (Lawal *et al.*, 2019). Organic residues are a sustainable source of energy and reduce the expenses of inorganic fertilizer for crops (Sharma *et al.*, 2019). These problems oriented the usage of organic fertilizers whichhave many benefits providing nutrients in addition to improving soil permeability and structure (Khan*et al.*, 2017), application of poultry manure improve soils physical and chemical properties (AgbedeandOyewumi 2022). Poultry manure with doses 10-50 t ha-1 positive impact on soil physical attributes such as soil temperature, water holding capacity and improve the number of pores (Mohamed & Hammam2019), chicken manure positively increased cucumber growth in sand soil under low salts (Abul-Soud *et al.*, 2008)and growth and yield in Silt loam soil(Khan*et al.*, 2017).Farmyard manure has been used as a soil conditioner since ancient times and its benefit have not been fully harnessed due to large quantities required in order to satisfy the nutritional needs of crops (Makinde *et al.*, 2007). Organic manures can sustain cropping systems through better nutrient recycling and improvement of soil physical attributes. The use of inorganic fertilizer has not been helpful under

intensive agriculture because of its high cost and it is often associated with reduced crop yields, soil degradation, nutrient imbalance and acidity. Cucumber production in most part of Sudan is fast becoming popular, probably due to its high nutritional and medicinal values, as well as being a useful component ingredient in the canteens preparation of salad and liquor drink in hotels and homes.Therefore, growing vegetables in a green house is needed in Sudan to provide more food especially in the off-season; Sudan has a big mount of livestock and huge amounts of manure for high and safety vegetables products. The main objectiveof this study wasto investigate the effect of soil types and the appropriate chicken manure dose on cucumber to produce high level of growth and yield under greenhouse.

2. MATERIALS AND METHODS

Soil samples were taken from each locationsubjected to physical and chemical analysis. Three types of soil namely Clay, Sandy and Sandy clay were taken from different locations,and were designated as follows: Sandy (S), Sandy clay (Gardud) (G) and Clay (C),and doses of Chicken manure were added ,using drip irrigation devices, and metric tape, one-meter, ruler, digital balance, vernia caliper, cucumber seeds and polyethylene bags were used as measurements materials.

2.1 Experimental Area Layout

This experiment was conducted at the greenhouse of Faculty of Natural Resources and Environmental Studies, University of Kordofan at Elobeid in two consecutive seasons 2017 / 2018. Randomized Complete Block Design (RCBD) with four replicates were used where three types of sandy, sandy clay (Gardud) and clay soils were prepared inside the greenhouse each with (4 m x 0.7m). Treatments were chicken manure (5 ton/ha), double dose of chicken manure (10 ton/ha) as well as control with zero- fertilizer were applied to filled pots with Sandy, Sandy clay and Clay soils with four replicates.

2.2 Soil physical analysis

2.2.1 Soil moisture content

Soil moisture content was measured followeing the described method by Deangelo's, (2007)on dry base as follow:

$$MC = \frac{M_w - M_s}{M_s} \times 100 \quad \text{2.2.1}$$

2.2.2 Soil bulk density

Soil bulk density was determined by followeing methodof Lark*et al*., (2014) as follow:

$$\rho_b = \frac{M_s}{V_t} \quad \text{2.2.2}$$

2.2.3 Soil porosity

Porosity of soil was determined as the method of Hao*et al*., (2008) as followig

$$E = 1 - \frac{\rho_b}{2.65} \quad \text{2.2.3}$$

2.3 Growth and Yield Attributes Measurement

Cucumber (Hybrid) seeds were sown in the plots and irrigation using drip irrigation system. During growing period and at maturity stage the following growth and yield attributes from the sampleof : 10 plants/plotwereused measures the following characters:

A: Plant height: it was measured using 1-meter ruler.

B: Number of leaves / plant.

C: Stem diameter: stem diameter was measured by using caliper (Vernia).

D: Leaf area/plant: measured by multiply Length x broad width of the leaf x leaves number.

E: Number of fruits / plant.

F: Weight of fruits: weight of fruits / plant was determined using digital balance.

G: Crop yield: in each subplot cucurbit fruits were weighted and the yield was calculated using the following equation:

$$Y = \frac{10 \times W}{A} \quad \text{.....2.3.}$$

Where,

Y = yield t/ ha.

W = weight of fruits kg/ plot.

A = plot area (m^2).

3. RESULTS AND DISCUSSI ON

3.1Soil physical analysis

Results showed that (Table 1) Clay soil emerged the highest moisture content 23.0 % and the lowest one 9.4% obtained by sandy soil, these result agree with (Agbede*et al.*, 2017) while the highest bulk density was registered in "Gardud"and sandy soils1.62 and 1.60 g / cmrespectively and Clay soil recorded the lowest one, these result is in line with (Agbede*et al.*, 2017), According to soil analysis from the tested samples, Clay soil showed the highest porosity48% and highest infiltration rate 8.9 (cm/hr) wasfound in Sand soil. Determined soil moisture content, porosity and infiltration rate were increased by adding chicken manure and these results agreed with (Wayne*et al.*, 2011).

Table1: Soil physical properties during growing period

Soil Types	M.C.%	Bulk density g/cm^3	Porosity%	Infiltration rate
Clay	23.0a	1.27b	48a	3.39b
Sand	9.4b	1.6a	40b	8.9a
Sand clay	21.5	1.62a	39b	2.55c

Values in same column with the same superscript letter show no significant differences at portability (0.05) levels.

3.2 Chicken manure chemical composition.

Chemical composition showed that (Table 2) Chicken manure which brought from the vetrinary poultry farm in Ministry of Agricluture and Animal Wealth in

Elobied city – North Kordofan State. Samples of chicken manures were analyzed in the laboratory of Soil and Water Sciences Department. to determiene the chemical constituents of the material and the chemical compostion of the manure is demonstrated. Obtained results represent the reasonable limit for the plant compared to previous studies, simillar result of (Abumere *et al*., 2019).

Table2: Chicken manure chemical composition

PH	6.20
Potassium%	1.81
Sodium%	0.08
Calcium%	3.10
Magnesium%	3.85
A.V Phosphorus%	0.002
T.Nitrogen%	20.1
O.M%	24.0

3.3. Cucumber growth parameters:

Plant measurements showed that (Table 3) the highest plant height was found in clay soil treated with chicken manure 10ton/ha (C10ton)(336.5cm) while the lowest height was recorded with Gardud soil without chicken manure (G0)198.8(cm) plant height increased due tohigh nutrients contents in the these organic fertilizer agree with that obtained by (Sri Pratiwi Aritonang, 2018). In the same way highest leave area and stem diameter (cm) was found in plant grown in clay soil treated with chicken manure 10ton/ha respectively (49.25dcm^2, 1.23cm) while the lowest leave area and stem diameter was found in untreated Sand soil (S0) respectively (20.5 cm^2, 0.65 cm) these results were similarly of Maaz Khan *et al*., (2017) obtained the leaf area and plant growth was increased when added poultry manure, and in the same as (Mehran jandaghi, 2020) findings. Tea was increased up to 50%andstem diameter was significantly increased with added amount of chicken manure.The highest number of leaves/plant was showed in Gardud soil with 10ton/ha chicken

manure (G10ton (46)followed with clay soil treated with fertilizer 10 ton dose (C10ton/ha) while the lowest number of leaves/p was found in Gardud soil without treat (G0)(21). These findings in the same lineof (Maaz khan *et al*., 2017) number of leaves captured more sun light to promote the photosynthesis and respiration when poultry manure is added.

Table 3: Effect of soil types andChicken manureon the growth of cucumber

Soil Treatment	Plant height(cm^3)	Leave area(dcm^2)	Stem diameter(cm^3)	Number of leaves/plant
S0	202.5cde	20.5c	0.65f	27bcd
S5ton	201.8cde	26.5c	0.8ef	31bc
S10ton	207cde	36.00abc	0.95bcd	36b
G0	198.8de	31.00bc	1.05abc	21cde
G5ton	245.8bc	35.25abc	1.18a	27bcd
G10ton	272.5b	32.00abc	1.13ab	46a
C0	231.3bcd	27.00c	0.83def	22cde
C5ton	253.8b	31.25bc	1.15ab	35b
C10ton	336.5a	49.5a	1.23a	43.75ab

*Values in same column with the same superscript letter show no significant differences at probability (0.05) levels.

3.4 Effect of chicken manure and soil typeon plant productivity:

Results Showed that (Table 4) the highest Yield kg /plant of cucumber clay soil treated with fertilizer 10 ton dose (C10ton/p) (13.88kg) followed by both of clay soil under 5ton/p of chicken manure (C5ton) and Gardud soil with 10ton/p (G10ton) (11.33kg)while the lowest yield kg/p was recorded with Sand soil with no fertilizer (S0) (4.63kg) obtained results similar to Maaz Khan*et al.*, (2017) findings. The highest Yield ton/ha of cucumber wasfound in Clay soil treated with 10tonof chicken manure(C: 10 ton) (239.58ton/ha) while the lowest yield ton/ha was showed in Sand soil with no treatmentS0 (83.30ton/ha). The result is on line with (Maaz, 2017). The highest Fruits number/plant was found in plant

grown in Clay soil treated with 5ton on poultry manure (C5ton) (44.00) followed by the same soil treated with double dose of chicken manure (C10ton) (43.00) while the lowest fruits number/plant was registered with Sand soil without manure (S0) (25.00) these result in same way of (Okla, 2015) chicken manure enhanced and increased number of fruits and quality of marketable fruits and weight was increased.

Table 4: Effect of soil types andChicken manure on the productivity of cucumber

Soil Treatment	Yield (kg/plant)	Yield(ton/ha)	Fruits number/plant
S0	4.63e	83.30d	25.00f
S5ton	9.25d	157.3ab	34.75bcde
S10ton	11.5ab	155.2ab	42.00ab
G0	4.88e	149abc	25.75ef
G5ton	9.75bcd	195.4ab	35.00abcd
G10ton	11.88ab	201.2ab	39.5abc
C0	5.13e	106.2	26.5def
C5ton	11.88ab	178abc	44.00a
C10ton	13.88a	239.6a	43.75ab

*Values in same column with the same superscript letter show no significant differences at probability (0.05)levels.

4. Conclusion

These experiment was conducted in green house of Faculty of Natural Resources and Environmental Studies to investigate the effect of soil types and (Chicken manure 10 t/ha and 5t/ha) on growth and yield attributes of cucumber. Soil physical properties were improved noticeably inside the greenhouse as compared with initial properties in the field when the different application manure was added.In general, two doses of chicken manure applied in clay soil gave the good results in most studied parameters compared with other soil types,

while the lowest values were given by the interaction of sand soil with control (zero manure).

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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