

Effect of soil types and Chicken Manure on Cucumber (*Cucumis sativus* L.) Growth and Yield under Greenhouse Conditions.

ABSTRACT:

This study was conducted at the greenhouse of the faculty of natural resources and environmental studies, university of kordofan at Elobeid, Sudan during 2017- 2018 to investigate the effect of soil types and chicken manure on cucumber (*Cucumis sativus* 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. The studied characters include growth parameters: - leaf area (dm^2), plant height (cm) stem diameter (cm), number of Leaves per plant. While the yield parameters include :- (number of fruits, yield (kg), yield / plant ton/ha). The data were statistically analyzed by using Statistics 8 program. The results generally showed significant differences among all treatments and their interactions, hence it is recommended that, 10 t/ha chicken manure fertilizer should be applied to obtain high number of fruits/plant with clay soil under tested condition.

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

1. INTRODUCTION

Cucumber (*Cucumis sativus* L.) is an important vegetable and one of the most popular members of the Cucurbitaceae family, and is an economically important fruit vegetable. (Khatriwad 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 and onion in Asia. There are three primary varieties of Cucumber; Slicing, pickling and Burpless (Rajawat *et al.*, 2017). The cucumber is initially from India however is currently grown in most continent. Cucumber is another 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). Vegetable plant effect with soil type and growth conditions, the quality/fertility status of soils is essential for growth and development for cucumber (Wang, 2021). In the last previous years, the rate of world population increasing and more area covered infrastructure, which decreased agriculture area and conventional agriculture shifted to modern agriculture like excess utilization of inorganic fertilizer, hybrid varieties, irrigation methods, pesticides *et.* Recent agriculture produces high yield, which reduces the requirement of food crises, but some problems created such as infertility of soil, new pest and diseases and health problems (Tavakoli *et al.*, 2013). Fertile soils significantly affect the quality and yield of the crop as compared to infertile soil, Rich soils with nutritional elements are used for the cultivation of cucumber; 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). Organic fertilizers have 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 (Agbede and Oyewumi 2022). Poultry manure with doses

10-50 t ha⁻¹ positive impact on soil physical attributes such as soil temperature, water holding capacity and improves the number of pores (Mohamed & Hammam 2019), 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 is good for diabetic patients as it contains low sugar and help in the burning of excess fat in the body (Shisode, 2021). Cucumber production in most part of Sudan is fast becoming popular, probable 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 objective to investigate the effect of soil types and the appropriate chicken manure dose on cucumber to produce high level of growth and yield under greenhouse conditions.

2. MATERIALS AND METHODS

Soil samples were taken from each locations subjected 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 was used where three types of sandy, sandy clay (Gardud) and clay soils were prepared inside the greenhouse each with (4 m x 0.7) m. Treatments were chicken manure (5 ton/ha), double dose of chicken manure (10 ton/ha) as well as control with no- fertilizer was 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 followed the described method by Deangelo's, (2007) on dry base as follow:

$$M.C = \frac{M_w - M_s}{M_s} \times 100 \dots\dots\dots 2.2.1$$

2.2.2 Soil bulk density

Soil bulk density was determined by followed method of Larket *al.*, (2014) as follow:

$$\rho_b = \frac{M_s}{V_t} \dots\dots\dots 2.2.2$$

2.2.3 Soil porosity

Porosity of soil was determined as the method of Haoet *al.*, (2008) as follow

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

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 sample of :(10 plants/plot) to measure 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:

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

Where,

Y = yield t/ ha.

W = weight of fruits kg/ plot.

A = plot area (m²).

3. RESULTS AND DISCUSSION

3.1 Soil 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 (Agbedeet *al.*, 2017) while the highest bulk density was registered in Gardud and sandy soils 1.62 and 1.60 g / cm³ respectively and Clay soil was recorded lowest one, these result in line with (Agbedeet *al.*, 2017), Clay soil showed highest porosity 50% and highest infiltration rate 8.9 cm/hr was found in Sand soil. Determined soil moisture content, porosity and infiltration rate were increased by adding chicken manure and these results agreed with (Wayneet *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 share same superscript letter show non 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 Dept. to determiene the chemical constituents of the material and the chemical compostion of the manure is demonstrated. Obtained results were 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 fertilizer (G0)198.8(cm) plant height increased due to high nutrients contents in the these organic fertilizer agree with that obtained by (Sri Pratiwi Aritionang, 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 (49.25dcm², 1.23cm) while the lowest leave area and stem diameter was found in untreated Sand soil (S0) respectively (20.5 cm², 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% and stem 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 line of (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 and Chicken manure on the growth of cucumber

| Soil Treatment | Plant height(cm³) | Leave area(dcm²) | Stem diameter(cm³) | 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 share same superscript letter show no significant differences at probability (0.05) levels.

3.4 Effect of chicken manure and soil type on 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 was found in Clay soil treated with 10ton of chicken manure (C10ton) (239.58ton/ha) while the lowest yield ton/ha was showed in Sand soil with no treat (S0) (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 and Chicken 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 share same superscript letter show no significant differences at probability (0.05) levels.

4. Conclusion

The experiment was conducted in green house of Faculty of Natural Resources and Environmental Studies to investigate the effect of soil types and fertilizer (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.

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 fertilizer).

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