

EFFECTS OF POULTRY MANURE LEVELS ON GROWTH AND YIELD OF CUCUMBER CULTIVARS

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ABSTRACT: A field trial was conducted to study the “effect of poultry manure levels (0, 10, 15, 20 t ha⁻¹) on the growth and yield of cucumber (*Cucumis sativus* L.) cultivars (Desi 36 Days, Market more, Poinsett 76 and S. Green)” at Horticultural Research Farm, University of Agriculture, Peshawar, Pakistan. The experiment was carried out in randomized complete block design (RCBD) with three replications. Both factors showed significant variations in growth and yield parameters. Early days to flowering (36.5), Maximum vine length (179.8 cm), number of branches plant⁻¹(4.5), numbers of leaves plant⁻¹(75.0), leaf area (147.8 cm²), fruit length (19.5 cm), fruit diameter (4.9 cm), number of fruits plant⁻¹(5.6), average fruit weight (174.8 g) and yield (38.3 t ha⁻¹) were observed in plants supplied with poultry manure @ 20 t ha⁻¹. Among cultivars, S. Green was best in all parameters except days to flowering. The S. Green cultivar showed significantly increased vine length (169.5 cm), number of branches plant⁻¹(4.4), numbers of leaves plant⁻¹(73.5), leaf area (138.8 cm²), fruit length (17.7 cm), fruit diameter (4.8 cm), number of fruits plant⁻¹(4.8), average fruit weight (177.4 g) and yield (33.2 t ha⁻¹). Early days to flowering (36.6) were noted in cultivar Desi 36 Days. The interactions were found non-significant in all parameters except average fruit weight. The application of poultry manure @ 20 t ha⁻¹ to S. Green cultivar induced high growth and yield. The S. Green cultivar can be commercially cultivated in Peshawar valley with the application of poultry manure @ 20 t ha⁻¹ for high growth and yield.

Key Words: Poultry manure (PM), cucumber cultivars (CV), randomize complete block design (RCBD), fruit length, fruit weight, fruit diameter, leaf area, vine length, days to flowering, yield

1. INTRODUCTION

Cucumber (*Cucumis sativus* L.) is an ancient annual vegetable belongs to the family Cucurbitaceae [1]. Cucumber was originated from an area in India between the Himalayas and the Bay of Bengal and the cultivation of cucumber was started about 3000 years ago [2]. In world vegetable market, the cucumber is fourth important vegetable crop in Asia [1]. China, Turkey, Iran, Russia and USA are peak cucumber producing countries in the world [3]. Vitamins and minerals are present in Cucumber. Silicon element also present in cucumber, which has positive effect on human health and skin. Cucumber controls the hypertension of human body and also avoiding kidney problems when eaten on regular basis [4]. Nature of cucumber is perishable and succulent; it's eaten as a salad and can also be cooked [5]. Cucumber plant requires moderate warm temperature, less humidity, optimum sun light and good soil texture [6]. The optimum temperature for cucumber growth is 20 °C to 25 °C and below or above of this temperature, the cucumber growth and yield is severally effected [7].

In the last few decades, 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 etc. Modern 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 [8]. Fertile soils significantly affect the quality and yield of the crop as compared to infertile soil [1]. Organic manure is a sustainable source of energy and reduces the expenses of inorganic fertilizer for crops [9]. Almost, 44% organic manure presents in the soil, which increases the

porosity 25% and moisture retaining up to 16 times [10]. Organic manure repairs the infertile soil such as improve the soil texture, color, mineral availability to plant, water retention ability and survival of microorganisms and the utilization of organic manure with a little amount of inorganic fertilizer highly increases crop productivity [11]. Organic manure extends the water retaining in sandy soil and improve drainage of clay soil while excess applications of inorganic fertilizer badly affect the soil formation, soil erosion and soil nutrients [12].

Growing of crops through organic manure contained non-toxic chemicals, good taste and maintained better health [13]. Poultry manure is used in agriculture from ancient times, which is economical and superior nutritive organic source for crops. The physical and chemical properties of soil improve with the application of poultry manure [14]. Poultry manure @ 10-50 t ha⁻¹ positive impact on soil physical attributes such as soil temperature, water holding capacity and improves the number of pores [15]. The concentration of N, P, K, Ca and Mg increased in sorghum leaves with the application of Poultry manure [16]. Poultry manure @ 24 t ha⁻¹ enhanced the vegetative growth and yield because poultry manure contains nitrogen 1.0-1.8%, P 0.4-0.8% and K 0.5-1.9% [17]. Application of poultry manure to the field is very difficult due to bulky size, but has a significant effect on the environment and soil fertility [1]. Infertility of Pakistan soil is the main cause of small productivity of cucumber. Low productivity is due to deficiency of essential nutrients and lack of natural fertilizer in the soil. Nitrogen plays the main role in the biochemical process of the plant. The low level of nitrogen results in decreasing the availability of other mineral nutrients [18]. Growing of inferior varieties is the main reason for low yield of cucumber. Therefore, many scientists

studied the performance of cucumber cultivars [19]. The varieties of cucumber exist in different color, length, shapes and nutrient content [20]. High yielding cucumber varieties reported by many Scientist that it might be due to genetic makeup and environmental condition [21].

Regular cropping and using unbalance of chemical fertilizer devastated the soil fertility and decreased the yield of cucumber in Pakistani soil. Poultry manure is not limiting to easy availability, but also provide all essential nutrients to the plants and maintaining the soil fertility and give superior growth and yield [22]. The cucumber has great potential in Pakistani soil, but until the local cultivars of cucumber are not identified to give a positive response to poultry manure, therefore, the present research was aimed to determine the optimum level of poultry manure for better cucumber production and identify the high yielding cucumber cultivar for Peshawar growers.

2. MATERIALS AND METHODS

Description of experimental site

The experiment was conducted at Horticulture Research Farm, University of Agriculture, Peshawar, Pakistan.

Soil analysis

Before the application of poultry manure and basal doses of chemical fertilizers, the soil samples were collected at depth of 15 to 25 cm and analyzed for different physicochemical properties in the laboratory of soil science. The physicochemical properties are shown in Table 1.

Table 1: Physio-chemical properties of soil

Soil characteristics	Value
Total nitrogen	0.183%
AB-DTPA extractable P	0.4123 mg kg ⁻¹
AB-DTPA extractable K	59.3 mg kg ⁻¹
Texture	Silt loam
Organic matter	0.1022%
CaCO ₃	15.5%
EC	0.215 dSm ⁻¹
PH	7.66

Poultry manure analysis

Poultry manure was brought from poultry farm of the university. The poultry manure analysis was conducted in soil laboratory, The University of Agriculture Peshawar. Poultry manure analysis is shown in Table 2.

Table 2: Poultry manure analysis

Poultry manure properties	Value
Nitrogen (N)	2.84%
Phosphorous (P)	0.93%
Potassium (K)	1.09%
Calcium (Ca)	4.9 c mol kg ⁻¹
Magnesium (Mg)	3.32 c mol kg ⁻¹
pH	7.52

Experimental design

The experiment was conducted in a randomized complete block design (RCBD) having three replication and two factors. Plot size was 3×3 m. The bed width was 1.5m and beds were apart from each other at 0.5 distance.

Factor A

Poultry Manure Levels (t ha⁻¹)

$$P_1 = 0 \text{ t ha}^{-1}$$

$$P_2 = 10 \text{ t ha}^{-1}$$

$$P_3 = 15 \text{ t ha}^{-1}$$

$$P_4 = 20 \text{ t ha}^{-1}$$

Factor B

Cucumber Cultivars

Desi 36 Days

Market More

Poinsett 76

S. Green

Fertilizer application

After the field preparation, well-decomposed poultry manure was applied to all beds. In addition to poultry manure @ 50 kg ha⁻¹ ammonium sulphate, 100 kg ha⁻¹ of superphosphate and 55 kg ha⁻¹ potassium sulphate. Ammonium sulphate was also applied @ 40-60 kg ha⁻¹ in two doses at the time of plants started runners and second when fruit was started.

Preparation of land and sowing

The land was ploughed three times and beds were made. The seeds were scattered on beds and field was irrigated. After germination of seeds, thinning was not done until the infestation of beetle was completely over.

The following parameters were studied during the course of experiment: Days to flowering, vine length (cm), number of leaves plant⁻¹, leaf area (cm²), number of branches plant⁻¹, fruit diameter (cm), fruit length (cm), fruit weight (g), number of fruits plant⁻¹, yield (t ha⁻¹).

After harvesting, yield (t ha⁻¹) was calculated by the following formula:

$$\text{yield}(t \text{ ha}^{-1}) = \frac{\text{plot yield}(kg)}{\text{plot area}(m^2)} \times 10000m^2$$

Statistical analysis

The research detail was analyzed statistically using ANOVA technique and the means was compared by LSD-test of significance by statistics software [23].

3. RESULTS AND DISCUSSIONS

Days to flowering

The effects of both poultry manure levels and cultivars on days to flowering were found statistically significant ($p \leq 0.05$), whereas their interaction was found non-significant. Early flowering (i.e. after 36.5 days) was observed in plants supplied with poultry manure @ 20 t ha⁻¹, while late flowering (i.e. after 43.7 days) was recorded in plants of the control group (Table 3). In case of cultivars, early flowering (i.e. after 36.6 days) were noted in Desi 36 Days, whereas late flowering (i.e. after 43.5 days) were recorded in S. Green cultivar. The early flowering was initiated due to the high concentration of phosphorus and potassium present in poultry manure. Jilani et al [24] reported that macronutrients deficiency results in a delay in flowering. The difference in days to flowering was assumed as due to the difference in genetic nature of the different cultivars and environmental factors. Hamid et al [25] also noted that variations were occurred in flowering days of different cultivars due to the difference in genetic makeup and environmental conditions.

Vine length (cm)

The data concerning to vine length is presented in Table 3. Results showed that the vine length was maximum (179.8 cm) in plants which received poultry manure @ 20 t ha⁻¹, whereas the minimum vine length (142.5.0 cm) was noted in control. The highest vine length in plants with a highest

poultry manure level indicating that an increase in poultry manure level cause increase in the vine length of cucumber. In case of cultivars, maximum vine length (169.5 cm) was obtained in S. Green followed by Desi 36 Days (164.9 cm), while the minimum vine length (157.9 cm) was noted in Poinsett 76. The increase in vine length might be due to more organic matter in the soil, because it has more water holding capacity and releases the nutrients in the soil. In such situation, the rate of plant metabolic processes are improved and in response, the growth also is also increased. These results resemble with the findings of Adekiya and Ojeniyi [26] and Ewulo et al [15] which confirmed that the poultry manure was not only a rich source of nutrients, but it also helped to make available those nutrients to the plants which were already present in the soil. John et al [27] who also stated that the incorporation of poultry manure to the soil made available more essential elements to the plants, which promoted high photosynthetic activities for maximum growth and yield of watermelon.

Numbers of branches plant⁻¹

According to results, the highest numbers of branches plant⁻¹ (4.5) were observed in those plants to which highest level of poultry manure was applied (i.e. @ 20 t ha⁻¹) and the lowest numbers of branches plant⁻¹ (3.6) were noted in control plants (Table 3). With concern to cultivars, the maximum numbers of branches plant⁻¹ (4.4) were found in S. Green followed by Desi 36 Days (4.0), whereas the minimum numbers of branches plant⁻¹ (3.7) were recorded in Poinsett 76. Increased poultry manure level increased the numbers of branches plant⁻¹, because high concentrations of nutrients were present in poultry manure which encouraged the growth of the plant. The results of Dauda et al [28] also indicating that the water melon requires more nutrients for vigorous vegetative growth. According to the results of Enujeke [14], high levels of poultry manure encouraged the production of maize. The genetic makeups of cultivars and environmental factors also have a significant effect on the growth of plants. This was also noted by Young et al [29] who stated that variation in plant growth was due to genetic nature of cultivars.

Number of leaves plant⁻¹

The increased amount of poultry manure increased the number leaves in cucumber plants. The number of leaves plant⁻¹ in plants supplied with poultry manure @ 20 t ha⁻¹ was 75.0 and the plants received no poultry manure had 59.4 number of leaves plant⁻¹. In cultivars, the S. Green had 73.5 numbers of leaves plant⁻¹ which was the maximum and Desi 36 Days (70.1). The minimum number leaves plant⁻¹ (64.9) was recorded in Poinsett 76 (Table 3). The cause of maximum numbers of leaves plant⁻¹ might be the organic manure; it made the soil more fertile and favorable for plant growth. Poultry manure contains nitrogen which boosts the growth of the plant. This statement is approved by the results of Mangila et al [22] and Enujeke et al [14] who reported that poultry manure (which is superior animal manure) was contained more nutrients, which improved the physical condition of soil for plant growth and development. Similar results were also found by Agbede et al [16] and Ewulo et al [15] who said that the high concentration of nitrogen present in poultry manure, easily available to plants, produced high

production, decreased the temperature, bulk density, and improved the total porosity of the soil.

Leaf area (cm²)

Maximum leaf area (147.8 cm²) was noted in plants supplied with poultry manure @ 20 t ha⁻¹, while minimum leaf area (116.7cm²) was found in control group (Table 3). With regard to cultivars, highest leaf area (138.0 cm²) was noted in S. Green, followed by Desi 36 Days (136.5cm²), while lowest leaf area (124.7 cm²) was recorded in Poinsett 76. The plants which receive more light have maximum leaf area because more light capturing causes more transpiration and photosynthesis. Leaf area increases with the increase of poultry manure level. It might increase the concentration of nitrogen and improve the soil chemical and physical properties which in turn enable the plants to take up more nutrients from the soil easily. These results resemble with the findings of Adesina et al [30], Aliyu [31, 32] and Alabi [33] who stated that poultry manure improved the vegetative growth of pepper plants, and enhanced the nutrients uptake.

Table 3: Days to flowering, vine length, number of branches pant⁻¹, number of leaves plant⁻¹ and leaf area of cucumber cultivars as affected by poultry manure

Poultry manure	Days to flowering	Vine length (cm)	Number Of branches pant ⁻¹	Number of leaves plant ⁻¹	Leaf area (cm ²)
0 tha ⁻¹	43.7 c	142.5 d	3.6 c	59.4 c	116.7 d
10 tha ⁻¹	41.3 b	159.7 c	3.8 c	69.4 b	125.2 c
15 tha ⁻¹	38.3 a	171.2 b	4.1 b	71.7 ab	136.8 b
20 tha ⁻¹	36.5 a	179.8 a	4.5 a	75.0 a	147.8 a
LSD at p≤0.05	2.217	6.457	0.270	4.752	2.054
Cultivars					
Dasi 36 days	36.6 a	164.9 ab	4.0 b	70.1 bc	136.5 b
Market more	39.3 b	160.9 bc	3.8 bc	66.9 b	124.7 c
Poinsett76	40.3 b	157.9 c	3.7 c	64.9 b	124.7 c
S.Green	43.5 c	169.5 a	4.4 a	73.5 a	138.0 a
LSD at p≤0.05	2.217	6.457	0.270	4.752	2.054

Fruit length (cm)

The poultry manure levels and cultivars significantly effected (P≤0.05) the fruit length of cucumber. Maximum fruit length (19.5 cm) was seen in plants, which received poultry manure @ 20 t ha⁻¹, while minimum fruit length (12.9 cm) was observed in plants which not received any poultry manure (Table 4). In cultivars, the S. Green showed the largest fruit length (17.7 cm) followed by Desi 36 Days with 16.6 cm. The poinett 76 showed the smallest fruit length of 15.8 cm. The fruit length might be increased due to the optimum amount of macro and micro nutrients available in poultry manure, which is required for the synthesis of photo assimilates and the enhanced amount of photo assimilates produced maximum fruit length. Similar results were noted by Adediran et al [34], he found that the high level of poultry manure as a rich source of nutrients, significantly increased

the fruit length. Agyarko and Asiedu [35] also reported that fruit size and fruit girth of cucumber was improved with poultry manure application. The cucumber fruit size also depends on the genetic makeup of cultivars. A similar statement was presented by Simon [20]. Simon states that the fruits of different cucumber cultivars are different from each other in color, size, shape and length due to the difference in their genetic makeup.

Fruit diameter (cm)

Table 4 shows changes in fruit diameter of different cultivars. The fruit diameter was increased from 4.2 cm in control group to 4.9 cm in the plants received poultry manure @ 20 t ha⁻¹. In the mean table, cultivar S. Green is showing maximum fruit diameter (4.8 cm) followed by Desi 36 Days (4.6cm), while minimum fruit diameter (4.1 cm) was recorded in Poinsett 76. Poultry manure increases the water holding capacity and moisture in the soil which in turn the uptake of nutrients from the soil become easy for the plants. Those plants which receive all the essential nutrients grow vigorously and give more yields. A similar statement was reported John et al [27] who noted that poultry manure increased the growth and yield of crops.

Numbers of fruit plant⁻¹

The number of fruits plant⁻¹ was 5.6 in plants to which poultry manure was applied @ 20 t ha⁻¹ and 3.2 in plants which did not receive poultry manure (Table 4). This indicating that high poultry manure level improved the yield in cucumber cultivars. From Table 4, it is clear that more number of fruits plant⁻¹ (4.8) was noted in S. Green as compared to others, whereas less number of fruits plant⁻¹ (4.1) was showed by Pointsett 76. Poultry manure improved the availability of nutrients to plants, bulk density and the water holding capacity of the soil. This, in turn, increases the vegetative growth, accelerate the division of meristematic tissue and metabolic reactions and the plants take more food as a result of which increase in the number of fruits plant⁻¹ occurred. The results are in line with Dauda et al [28] who reported that poultry manure as a rich source of nutrients improved the soil texture and encouraged the nutrients uptake by the plants which enabled the plants to become healthy and produce more fruit in water melon. Gupta and Shukla [36] and Nwokwu and Anickwe [37] reported that variation in the average fruit weight of watermelon cultivars was due to the genetic variations.

Average fruit weight (g)

Maximum average fruit weight (174.8 g) was observed in plants supplied with poultry manure @ 20 t ha⁻¹, while the minimum average fruit weight (155.9 g) was noted in those plants which did not receive poultry manure (Table 4). In case of cultivars, highest average fruit weight (177.4 g) was obtained in S. Green, while the lowest average fruit weight (157.3g) was found in Poinsett 76. The increase in average fruit weight might be due to the high concentration of nutrients in high poultry manure level which boost up the growth and yield. Similar results were obtained by Dauda et al [28] who noted that high poultry manure level which is a rich source of nitrogen, phosphorus, magnesium and calcium increased the fertility of the soil due to which the fruit weight

4. CONCLUSIONS

was increased significantly. Aliyu [31, 32] reported an increase in average fruit weight by high poultry manure level.

Yield (t ha⁻¹)

The yield was increased from 19.2 t ha⁻¹ in control plants to 38.3 t ha⁻¹ in plants which received poultry manure @ 20 t ha⁻¹. Adediran et al [34] also reported that poultry manure @ 20 t ha⁻¹ having a high concentration of plant nutrients, produced maximum yield in tomato plants. With regard to cultivars, the yield was highest (33.2 t ha⁻¹) in S. Green followed by Desi 36 Days with 30.0 t ha⁻¹ yield (Table 4). The yield was lowest (25.6 t ha⁻¹) in Poinsett 76. The background of high yield was more number of leaves plant⁻¹, which captured more sun light to promote the photosynthesis and respiration and as a result, the plant produced maximum yield. The findings are similar to the results of O'Hare [38] who reported that high yield was observed due to the vigorous vegetative growth of plants.

Table 4: Fruit length, fruit diameter, number of fruits plant⁻¹, average fruit weight and yield of cucumber cultivars as affected by poultry manure levels

Poultry manure	Fruit length (cm)	Fruit diameter (cm)	Number of fruit plant ⁻¹	Average fruit weight (g)	Yield (t ha ⁻¹)
0 tha ⁻¹	12.9 d	4.1 c	3.2 d	155.9 d	19.2 d
10 tha ⁻¹	15.5 c	4.4 b	4.1 c	165.4 c	26.6 c
15 tha ⁻¹	18.1 b	4.5 b	4.8 b	169.5 b	31.9 b
20 tha ⁻¹	19.5 a	4.9 a	5.6 a	174.8 a	38.3 a
LSD at p≤0.05	0.764	0.344	0.323	3.352	1.591
Cultivars					
Dasi 36 days	16.6 b	4.6 ab	4.6 ab	168.9 b	30.0 b
Market more	15.9 bc	4.3 bc	4.3 bc	162.0 c	27.2 c
Poinsett76	15.8 c	4.2 c	4.1c	157.3 d	25.6 d
S. Green	17.7 a	4.8 a	4.8a	177.4 a	33.2 a
LSD at p≤0.05	0.764	0.344	0.323	3.352	1.591

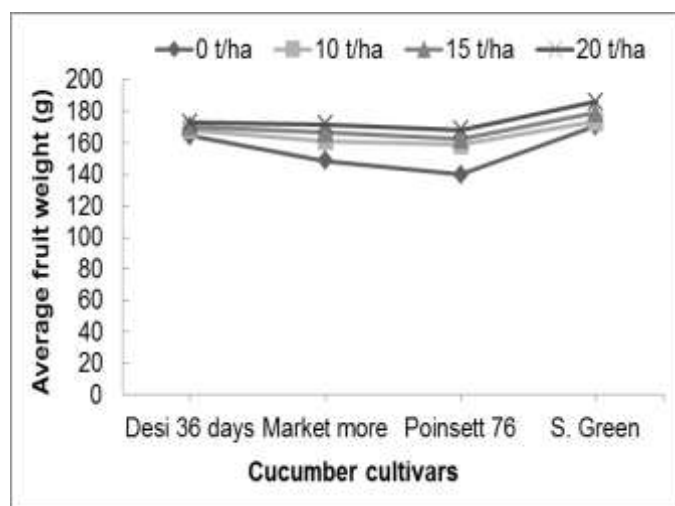


Figure 1: Average fruit weight (g) of cucumber cultivars as affected by poultry manure levels

On the basis of above findings, it can be concluded poultry manure significantly increased the growth and yield of

cucumber cultivars. The poultry manure level @ 20 t ha⁻¹ was determined to be the most appropriate amount for enhancing all the parameters of growth and yield. S. Green was found to be the best cultivar of cucumber as concerned to yield and growth. Cultivar S. Green can be cultivated with the application of poultry manure @ 20 t ha⁻¹ for better growth and yield in Peshawar valley.

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