

The Effect of Three Types of Organic Fertilizers on Some Vegetative Growth and Chemical Characteristics of Two Cultivars of Cucumber Plants (*Cucumis melo flexuosus*)

¹Azhar Rumaid Haza² & Ibrar Aqeel Nasser

^{1,2}Department of Horticulture and Landscape Gardening/ College of Agriculture / University of Tikrit

Abstract

The experiment was conducted at the research station of the Department of Horticulture and Landscape Gardening, College of Agriculture, University of Tikrit, for the 2024 agricultural season. It aimed to study the effect of three types of organic fertilizers and two varieties of *Cucumis melo flexuosus* (snake cucumber). The experiment included two factors: the first involved three organic fertilizers (cattle manure, sheep manure, and poultry manure) in addition to a control treatment; the second factor involved two varieties of snake cucumber (Variety 1: SURYA PRABHA and Variety 2: ACUR ANTER). The experiment was carried out according to a Randomized Complete Block Design (R.C.B.D.) in a Split-Plot arrangement, with the fertilizer factor assigned to the main plots and the variety factor assigned to the sub-plots. The results can be summarized as follows: Fertilizer treatments with cattle and sheep manure outperformed the control and poultry manure treatments in terms of chlorophyll percentage for the varieties, with cattle manure giving 48.22%. Regarding interaction effects between fertilizers and varieties, Variety 1 (V1) with poultry manure outperformed some other interactions in the traits of plant length and number of main branches, giving (168.33 cm plant⁻¹ and 17.33 branches plant⁻¹), respectively. For leaf area, the interaction of Variety 2 with sheep manure outperformed others, and for chlorophyll percentage, the interaction of Variety 2 with cattle manure outperformed some other interactions, giving 136.17 cm² plant⁻¹ and 48.70%, respectively. The interaction between fertilization with cattle manure and Variety 2 outperformed some other interactions in potassium percentage, giving 4.43%.

Keywords: *Cucumis melo flexuosus* , Varieties, Organic fertilization

Introduction:

Cucumber (*Cucumis sativus*) is a member of the Cucurbitaceae family. It is a monoecious plant, bearing separate male and female flowers on the same plant, and is considered a summer vegetable whose fruits are consumed fresh or pickled (1). Organic fertilizers play a crucial role in enhancing plant production by maintaining soil fertility and improving soil structure. They help create suitable environmental conditions for plant growth, such as increasing soil aggregate formation and stability, reducing bulk density, and minimizing surface erosion, especially in sandy soils. Plant and animal residues, along with soil microorganisms, constitute the organic matter that decomposes in the soil-by-soil organisms under suitable conditions of moisture, aeration, temperature, and pH. This decomposition results in biochemical compounds called non-humic substances, which constitute approximately 10-15% of the material and include carbohydrates, proteins, amino acids, fats, pigments, and organic acids. Humic substances, however, form the larger proportion (85-90%) and represent the products formed through secondary synthesis processes. They are classified according to their molecular weight and properties into fulvic acid (low molecular weight, extracted from soil with acidic and basic solutions), humic acid (high molecular weight, extracted with basic solution), and humin (insoluble in soil)

2. Materials and Methods

2.1 Experiment Location

The experiment was conducted at the Agricultural Research Station of the Department of Horticulture and Landscape Gardening, College of Agriculture, University of Tikrit, during the autumn agricultural season of 2024. It aimed to

(3,4,5). Genetic variation among cultivars is a major determinant of agricultural performance. The existence of wide genetic diversity provides an opportunity to select superior individuals with high production traits and greater ability to resist environmental or biological stresses. Recent studies have shown that low genetic variation leads to reduced flexibility of the agricultural system and its responsiveness to changing challenges. In contrast, genetic diversity, especially through strategies such as evolutionary breeding and cultivar mixtures, can improve production stability and strengthen the ability of cultivars to adapt to future environmental diversity (6). (7) found that studying seven cucumber cultivars grown in a greenhouse showed superior results in fruit yield per plant for the 'Aakron' and 'Terminator' cultivars. In another study, (8) worked on local gynococious cucumber plants using five other hybrids, where the fourth and fifth hybrids (B4 and B5) excelled in giving the highest yield per plant. Based on the above, this study aims to determine the best types of animal manure used to provide the best vegetative growth indicators and yield, in addition to identifying which of the two cultivars is better in terms of productivity, and determining the best interaction between cultivars and organic fertilization for achieving the highest yield.

study the effect of three types of organic fertilization (cattle, sheep, and poultry manure) on the vegetative growth and yield traits of two cultivars of snake cucumber (**Cucumis melo** var. **flexuosus**). Soil samples were collected from various

locations in the field at a depth of 0–30 cm, its physical and chemical properties. and the field soil was analyzed to determine

Table (1) Some physical and chemical properties of the field soil

con		Unit of Measurement	Trait
33		%	Sand
29		%	Silt
38		%	Clay
Sandy Loam			Texture
7.09			Soil Acidity (pH)
3.24		millimole	Electrical Conductivity
1.32		mg/kg	Organic Matter
11.3		mg/kg	Nitrate
12.11		mg/kg	Ammonium
16.7		mg/kg	Available Phosphorus
3.37		mg/kg	Potassium

Table (2) shows the weather data for the spring season of 2024.

The daily weather averages in Salah al-Din Governorate - Tikrit during the 2024 agricultural season.

Ministry of Agriculture	
Agricultural Meteorology Center Salah al-Din Governorate - Tikrit Station	
43.63°	Longitude E:
34.65°	Latitude N:

Radiation intensity W/m²	Average relative humidity (%)	Average maximum temperature (°C)	Average minimum temperature (°C)	The month
25.09	18.66	46.39	29.03	August
19.57	23.58	40.2	25.03	September
15.07	25.00	32.38	15.65	October

Agricultural Meteorology Center in Salah al-Din Governorate - Tikrit Station

Materials and Methods

Experiment Location and Weather Data

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manure) on the vegetative growth and yield traits of two cultivars of snake cucumber (*Cucumis melo* var. *flexuosus*). Soil samples were collected from various locations in the field at a depth of 0–30 cm, and the field soil was analyzed to determine its physical and chemical properties.

Field Preparation and Agricultural Operations

The field soil was prepared and ploughed using a disc plough with cross-ploughing. It was then smoothed, leveled, and divided into three plots (replicates), each measuring 19.5 m in length. The distance between plots was 3.5 m. Each plot contained eight experimental units, with each unit measuring 2 m in length and 0.6 m in width. The distance between experimental units was 0.5 m. Each experimental unit contained eight hills, with a distance of 0.5 m between hills. Planting was conducted on both sides of the plot on 10/8/2024. This resulted in a total of 24 experimental units derived from the

interaction between the cultivar and fertilization factors, using two snake cucumber cultivars and three types of organic (animal) fertilizers, in addition to a control treatment. The treatments were distributed according to a split-plot design, with cultivars assigned to the main plots and organic fertilization to the sub-plots. Fertilization was applied at the recommended rate of 10 tons per hectare (Adnan Nasser Matlob). Drip irrigation was used. The treatments were randomly distributed in the field as follows:

Studied Factors:

Organic (Animal) Fertilization:

- Cow Manure (C.M.)
- Sheep Manure (S.M.)
- Poultry Manure (P.M.)

Cultivar Factor:

- Cultivar 1 (SURYA PRABHA), denoted as V1
- Cultivar 2 (ACUR ANTER), denoted as V2

Statistical Analysis:

The data were statistically analyzed using a computer and the SAS (Statistical Analysis System) program. Means were compared

using Duncan's Multiple Range Test at a significance level of $P \leq 0.05$ (9).

Studied Traits:

- **Vegetative Growth Traits:**

Five plants were taken from each experimental unit, and the following measurements were recorded:

- **Plant Height (cm plant⁻¹):** Measured at the end of the growing season from the point where the stem meets the soil to the longest growing tip.
- **Number of Main Branches (branch plant⁻¹):** The number of main branches was counted at the end of the experiment, and the average was taken.
- **Plant Analysis and Estimation of Macronutrients (N, P, K) in Snake Cucumber Leaves:**

Leaf samples were taken randomly from different parts of the plant in each experimental unit during the fruiting stage. After thorough washing and air-drying at room temperature, they were placed in an electric oven at 65-75°C for 48-72 hours until a constant weight was achieved (10). Each sample was ground separately using an electric mill. A 1-gram portion of each ground sample was digested using the wet digestion method with a mixture of sulfuric and perchloric acids (60%). The digested material was then transferred to a 100 ml volumetric flask and made up to volume with distilled water.

- **Leaf Area (cm² plant⁻¹):** Calculated using the tracing method. Four leaves were taken from each seedling, traced, and the area was measured.
- **Leaf Chlorophyll Content (%):** The relative chlorophyll content of the leaves was measured using a SPAD meter. Four readings were taken per experimental unit, and the average was calculated.

Nitrogen concentration was determined using the micro-Kjeldahl method (11) as described by (12).

Phosphorus concentration was determined colorimetrically using a spectrophotometer as described by (12).

Potassium concentration was determined using a flame photometer as described by (12).

3. Results and Discussion

Vegetative Traits

- **Plant Height (cm plant⁻¹)**

As seen in Table (2), there were no significant differences in plant height for the main effects of fertilization or cultivar. Regarding the interaction effect, the interaction between Cultivar 1 (V1) and poultry manure outperformed some other interactions, giving a plant height of 168.33 cm plant⁻¹. This compares to the lowest value, which was recorded for Cultivar 2 (V2) with poultry manure, giving a height of 120.33 cm plant⁻¹.

2 Table Effect of organic fertilizers on plant height in two cultivars of snake cucumber.

Mean Effect of Cultivars	PM	SM	CM	Control	Fertilizer type
					Varieties
140.25 a	168.33 a	134.33 ab	125.00 ab	133.33 ab	V1
127.5 a	120.33 b	139.00 ab	120.67 b	130.00 ab	V2
	144.33 a	136.67 a	122.83 a	131.67 a	Mean effect of organic fertilizers

Numbers sharing the same letters do not differ significantly from each other according to Duncan's multiple range test at the 5% level.

• Number of Main Branches (branch plant⁻¹)

As observed in Table (3), there were no significant differences in the number of main branches for the main effects of fertilization or cultivars. Regarding the interaction effect, the interaction between Cultivar 1 (V1) and poultry manure

outperformed some other interactions, giving the highest value of 17.33 branches plant⁻¹. This compares to the lowest value for the same cultivar (V1) with cow manure, which was 9.33 branches plant⁻¹.

Table (3) Effect of organic fertilizers on the number of main branches in two cultivars of snake cucumber.

Mean Effect of Cultivars	PM	SM	CM	Control	Fertilizer type
					Varieties
13.08 a	17.33 a	13.67 ab	9.33 b	12.00 ab	V1
12.08 a	12.00 ab	10.67 b	15.33 ab	10.33 b	V2
	14.67 a	12.17 a	12.33 a	11.17 a	Mean effect of organic fertilizers

Numbers sharing the same letters do not differ significantly from each other according to Duncan's multiple range test at the 5% level.

• Leaf Area (cm²)

As observed in Table (4), there were no significant differences in leaf area for the main effects of fertilization or cultivars. Regarding the interaction effect, the

interaction between Cultivar 2 (V2) and sheep manure outperformed some other interactions, giving the highest leaf area of 136.17 cm². This compares to the lowest

value for the same cultivar (V2) fertilized with poultry manure, which gave a leaf area of 59.71 cm².

Table (4) Effect of organic fertilizers on leaf area in two cultivars of snake cucumber.

Mean Effect of Cultivars	PM	SM	CM	Control	Fertilizer type Varieties
79.41 a	77.13 ab	74.96 ab	89.40 ab	76.13 ab	V1
95.71 a	59.71 b	136.17 a	93.51 ab	93.45 ab	V2
	68.42 a	105.57 a	91.45 a	84.79 a	Mean effect of organic fertilizers

****Numbers sharing the same letters do not differ significantly from each other according to Duncan's multiple range test at the 5% level.****

• **Chlorophyll Content (%)**

As observed in Table (5), the effect of fertilization and cultivars on chlorophyll percentage is evident. The table shows that there are significant differences in fertilization, with cattle manure fertilization resulting in a chlorophyll percentage of 48.22%, which outperformed the poultry manure fertilization treatment (43.18%). Regarding the cultivar factor, no significant

differences were found for this trait. Concerning the interaction between the two factors, the interaction between fertilization with cattle manure and Cultivar 2 (V2) had a significant effect on this trait, achieving a chlorophyll percentage of 48.70%. This is compared to the lowest values found for the interaction treatments: Cultivar 1 (V1) with no fertilization and Cultivar 2 (V2) with poultry manure, which gave values of 41.90% and 39.87%, respectively.

Table (5) Effect of organic fertilizers on chlorophyll content in two cultivars of snake cucumber.

Mean Effect of Cultivars	PM	SM	CM	Control	Fertilizer type Varieties
45.50 a	46.50 ab	45.87 abc	47.73 ab	41.90 bc	V1
44.67 a	39.87 c	44.20 abc	48.70 a	45.90 abc	V2
	43.18 b	45.03 ab	48.22 a	43.90 ab	Mean effect of organic fertilizers

****Numbers sharing the same letters do not differ significantly from each other according to Duncan's multiple range test at the 5% level.****

Discussion

The results also show that cattle manure outperformed other treatments in

some physiological traits, such as chlorophyll percentage, reaching the highest

value compared to other treatments. This is explained by its higher content of micronutrients, especially iron and magnesium, which are essential for the structure of chlorophyll molecules and the functions of enzymes responsible for photosynthesis (13,14). Furthermore, the slow decomposition of cattle manure components leads to a gradual release of nutrients, maintaining a continuous supply of elements to the plant throughout the

- **Plant Analysis (Macronutrients in Leaves)**
- **Nitrogen Content (%)**

As observed in Table (6) there are no significant differences in nitrogen content

growth period. This positively impacts chlorophyll formation and enhances photosynthesis. As for the superiority of the interaction treatments in traits such as plant height, number of main branches, leaf area, and chlorophyll percentage, this may be attributed to either the fertilization factor, the cultivar factor, or the combined effect of both. These results are in agreement with the findings of (15).

for the main effects of fertilization or cultivars, nor for their interaction.

Table (6) Effect of organic fertilizers on nitrogen content in leaves of two snake cucumber cultivars.

Mean Effect of Cultivars	PM	SM	CM	Control	Fertilizer type
					Varieties
2.94 a	2.10 a	2.86 a	2.60 a	2.84 a	V1
2.81 a	2.85 a	3.25 a	2.89 a	2.79 a	V2
	2.90 a	3.05 a	2.73 a	2.82 a	Mean effect of organic fertilizers

****Numbers sharing the same letters do not differ significantly from each other according to Duncan's multiple range test at the 5% level.****

- **Potassium Content (%)**

As observed in Table (7), which shows the effect of adding organic fertilizers to two snake cucumber cultivars on potassium content, no significant differences were found for the main effects of fertilization or cultivars. However, regarding the interaction effect, the interaction between Cultivar 2 (V2) and cattle manure outperformed some

other interactions, giving a value of 4.43%. This is compared to the lowest values found for Cultivar 1 (V1) with cattle manure, Cultivar 1 with sheep manure, and Cultivar 2 (V2) with poultry manure, which gave values of 2.37%, 2.50%, and 2.50%, respectively.

Table (7)Effect of organic fertilizers on potassium content in leaves of two snake cucumber cultivars.

Mean Effect of Cultivars	PM	SM	CM	Control	Fertilizer type
					Varieties
2.73 a	3.23 ab	2.50 b	2.37 b	2.82 ab	V1
3.38 a	2.50 b	3.88 ab	4.43 a	2.71 ab	V2
	2.87 a	3.19 a	3.40 a	2.77 a	Mean effect of organic fertilizers

Discussion:

The increase in potassium content observed with the interaction between Cultivar 2 (V2) and cattle manure fertilization can be attributed to the use of cattle manure contributing to the improvement of soil chemical properties and increases cation exchange capacity, enhancing potassium availability to the plant. (16) explained that the organic matter resulting from the decomposition of animal manures releases organic acids that dissolve mineral elements, making them more available for uptake. Furthermore, the superiority of Cultivar 2 in

this interaction may be due to genetic differences between cultivars in terms of nutrient uptake efficiency and translocation within tissues, as some cultivars possess a greater ability to utilize nutrients from the soil medium, The results show that organic fertilizers led to slight increases in leaf nutrient content; however, these increases were not statistically significant. This aligns with the findings of (17), who noted that the effects of organic amendments are cumulative over time and sustainably improve the nutritional status of plants.

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