

Effect of Organic and Bio-fertilizer on some growth and physiological indicators of chili pepper cultivars

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Abstract

The research was carried out in a field at the horticulture and Forestry division/Al-Najaf Agriculture directorate, during the Spring growing season of 2021. It aimed to study the effect of organic and Bio-fertilizer on the growth and of chili Pepper, the first factor included three varieties local, Anaheim and Barbarian, while the Second factor included spraying with organic liquid fertilizer (Seaweed extract) at 4 gm g. L⁻¹, *Azotobacter chroococum* (15g.plant⁻¹) as a Bio-fertilizer and Combination of them with Control treatment. The Randomized Complete Block Design (R.C.B.D) was used modeling Split-Plot system with three replications. The Duncan Multiples Range Test was adopted to compare the means at the probability level of 0.05.

The results showed the superiority of the Barbarian variety in parameters of plant height and leaf area while the local variety recorded the highest value of the leaves number per plant and the dry matter of the vegetative system. Anaheim variety was superior in the leaves content of total chlorophyll. As for the nitrogen and phosphorous percentage, differences between the varieties were not noted. The application of liquid organic fertilizer plus bio-fertilizer showed significant superiority in all studied indicators.

Keywords: Seaweed Energie, *Azotobacter chroococum*, Barbarian, and Anaheim

Introduction

Chili pepper (*Capsicum annuum* L.) belongs to the Solanaceae family and it is counted as one of the main vegetable crops that many studies have addressed for its economic, nutritional, and medicinal importance (8). It is considered to be the third most important crop in the Solanaceae family after tomato and potato that is grown in most of the warm and temperate regions of the world (16). It has Chili pepper responds to fertilizer more than the rest of the Solanaceae family depending on the type of soil, environmental conditions, and growth stage (5). The addition of organic fertilizers including seaweed extract provides necessary nutrients for plant growth and development, which has a positive impact on the vegetative and qualitative growth parameters (17). This type of fertilization is a clean farming method that develops and improves the use of food systems and agricultural lands to maintain human and animal health from pollution resulting from the use of chemical fertilizers and pesticides.(1 and 18). That agrees with Mohammed *et al.* (19) who found that spraying sweet pepper plants with seaweed extract at a concentration of 3 g. L⁻¹ a significant increase in plant height, leaf area, wet weight, dry weight, and nitrogen ratio, and Fatima *et al.* (11) in a study they conducted on pepper and tomato plants in which algae were used with a concentration of 5 mg. L⁻¹, a significant increase was found in pepper plant height, plant dry weight, and root system.

Recently, some studies have used bio-fertilizers (*Azotobacter chroococcum*) since it shows a positive effect on reducing

high productivity and desired taste, which makes it widely used either as fresh, cooked, or hot spices (3). Chili is a source of Capsaicin which is an alkaloid extract that has medical uses such as cancer prevention, rheumatism treatment, lowering blood cholesterol, and relieving pain by affecting the neurotransmitter that transmits pain signals to the brain.

falling of flowers and an increase in the contract rate in flower, which occurs through the ability of the used organisms to stimulate plants to produce hormones such as auxins, gibberellins, and cytokinins as well as increase nitrogen fixation (9).this is consistent with what he found (25) in his study on two cultivars of chili pepper, another study carried out on pepper chili, cultivar Jacquin, in which *Azotobacter* was used, significant differences were found in plant height, a number of leaves, dry weight, nitrogen, and phosphorous ratio compared to untreated plants (Gomez-Alvarez *et al.*, 2008), Nalini *et al.* (20) explained in his experiment that he used a mixture of fertilizers, which consisted of bio-fertilizers, *Azotobacter* and *Bacillus megaterium*. A significant superiority was observed over the chili plant In increasing plant height number of leaves and paper area and total chlorophyll, this research aimed to determining the variety than can be cultivated well within the environmental conditions of the middle Euphrates region of Iraq And the role of organic and biological fertilization on chili pepper.

Material and Methods

A field study was conducted in Al-Najaf Directorate during the spring season of 2021. Random soil samples were collected

in different places for analyzing some physical and chemical parameters before planting in the laboratories of fadk for agriculture science (Table 1)

Table (1): Some physical and chemical soil indicators before planting

practical	Unit	amount
Clay	%	18.6
Silt	%	24.3
Sand	%	57.1
Soil texture	-----	Sandy loam
parameter	Unit	amount
EC	ds. M ⁻²	3.9
pH	-----	7.4
available nitrogen	mg.kg ⁻¹	38.8
available phosphorus	mg.kg ⁻¹	9.1
available potassium	mg.kg ⁻¹	223
Organic matter	%	1.2

The field was prepared for planting the seedlings by plowing the soil at a depth of 40-30 cm. Then, 40 m³.hectare⁻¹ of decomposed organic fertilizer was added to the soil and left for solar sterilization (4).

The seedlings were transplanted in the permanent field on 4/16/2021 and planted in the furrows. The width of each furrow was 0.5 m and the length was 6 m, therefore the area of one experimental unit was 3 m². The distance between the experimental units was 0.5 m.

The seedlings were planted in a side on the furrows, with a distance of 30 cm between plant and another, so the total number of plants in the experimental unit was 16 plants.

The plants were sprayed with 4 gm. L⁻¹ liquid organic fertilizer (seaweed) on vegetative growth until the complete wetness (according to the recommendations of the producing company). This application was repeated four

times during the growing season. The first spray was two weeks after planting the seedlings in the permanent field on 2/5/2021. The following sprays took place 15 days after each other.

As for the bio-bacterial fertilizer (*Azotobacter chroococcum*), it was prepared in the laboratories of the Al-Najaf Agriculture Directorate. Bacterial fertilizer was inoculated on the peat moss and added to the plant Rhizosphere three days after the preparation on 1/5/2021. The application rate was 15 g.plant⁻¹ (peat moss inoculation) (7), the vegetative growth indicators of the plant were measured by taking five plants randomly assigned from a total of sixteen plants in the experimental unit from each treatment, as follows:

The studied parameters included plant height, leaves number per plant and leaf area (cm².leaf) using the Digimizer program

described by Sadik *et al.* (24). Other measurements that were estimated the percentage of dry matter of the shoots (6), Total chlorophyll content ($\text{mg}\cdot 100\text{g}^{-1}$ fresh weight) (13), The percentage of nitrogen in the leaves (%) using the Micro kjeldhal (23), and the percentage of phosphorous in the leaves (%) using a Spectrophotometer (21).

Results and to Discussions

Results of table (2) showed that the Barbarian variety was significantly superior in plant height 89.73 cm, and the leaf area $2.714\text{ cm}^2\cdot \text{Leaf}^{-1}$. The local variety recorded a significantly higher number of leaves $2818.49\text{ leaves}\cdot \text{Plant}^{-1}$, and shoot dry matter 42.83%, which did not differ significantly from the variety of Anaheim 41.48%. Anaheim variety was superior in the leaves content of total chlorophyll $166.2\text{ mg}\cdot 100\text{ g}^{-1}$ fresh weights. The percentage of nitrogen and phosphorous did not show any significant differences regarding the varieties. These results agreed with the results of (2) who studied on sweet pepper plants and (14) who studied on chili pepper.

As for the effect of fertilizer applications, the fertilizer combination of spraying liquid organic fertilizer and the addition of bio-fertilizer gave the highest plant height 85.61 cm, leaf area $2.668\text{ cm}^2\cdot \text{Leaf}^{-1}$, the content of total chlorophyll $180.4\text{ mg}\cdot 100\text{ g}^{-1}$ fresh weights, nitrogen 2.38%, phosphorous 0.52%, and the number of leaves $2442.9\text{ leaves}\cdot \text{plant}^{-1}$.

The treatment of liquid organic fertilizer was significantly superior in the percentage of dry matter in the vegetative 48.60%. This result agrees with the finding of Issa *et al.* (15) in their study on the effect of marine algae on potato plants where seaweed was used as a spray on the leaves Compared and produced

an increase in leaf number, leaf area and dry matter compared to the control plants In an experiment carried out by Dawa *et al.*(10), it was found that the treatment of sweet pepper plant with marine algae recorded a significant increase in plant height, number of leaves , leaf area , chlorophyll and dry weigh

The superiority of the combination of spraying liquid organic fertilizer and adding bio-fertilizer on plant height, leaf area, and leaves number may be due to its role in providing soluble nitrogen. This was reflected in the vegetative growth characteristics represented in the manufacture and accumulation of nutrients by the process of photosynthesis, as well as the increase in the content of chlorophyll in the leaves. Nitrogen is included in the composition of one of the important compounds in building the chlorophyll molecule and increases the activity of enzymes responsible for the formation of the chlorophyll molecule, which results in an increase in the percentage of dry matter of the vegetative system. Pohl *et al.* (22) found that applying organic fertilizer leads to a significant increase in phosphorous on chili pepper leaves.

Conclusions:

The study revealed that the difference in the genetic structures of the studied varieties had a clear effect on the vegetative growth indicators. The local variety showed a significant superiority in increasing most of the vegetative growth indicators compared to the Barbarian and Anaheim varieties. Also, the combination of organic and bio-fertilizer had a significant effect in raising the percentage of elements The nutrients in the leaves and their chlorophyll content, which in turn affected the increase in the vegetative growth of the chili pepper plant

Table (2): The effect of cultivar and fertilizers on the vegetative and chemical growth indicators of leaves

Variety	Fertilizer treatment	plant height (cm)	Leaf area (cm ² /leaf)	total number of leaves	Vegetative dry matter %	Total Chlorophyll (mg/100g m)	nitrogen %	phosphorous %
Local	control	51.97 ef	1.109 f	785.33 de	29.73 bc	133.0 h	1.25 f	0.32 e
	Liquid organic fertilizer	62.57 def	1.802 de	2401.32 c	31.80 abc	155.7 e	2.08 de	0.40 d
	Bio-fertilizer	79.80 bcd	1.771 de	4499 a	50.03 ab	167.2 c	2.22 cd	0.44 c
	Liquid organic fertilizer + bio-fertilizer	76.93bcd	2.391 c	3588.34 b	59.77 a	181.4 a	2.42 a	0.53 a
Barbarian	control	80.57 bcd	1.527 e	254.67 e	20.80 c	139.7 g	1.20 f	0.32 e
	Liquid organic fertilizer	88.03 abc	2.682 b	308.10 de	21.97 bc	157.6 e	2.02 e	0.42 cd
	Bio-fertilizer	90.30 ab	2.894 b	374.09 de	29.40 bc	164.1 cd	2.10 de	0.43 cd
	Liquid organic fertilizer + bio-fertilizer	100.02 a	3.754 a	406.22 d	35.57 abc	178.8 a	2.39 ab	0.53 ab
Anaheim	control	44.17 f	0.926 f	1039.62 de	30.80 bc	150.8 f	1.34 f	0.34 e
	Liquid organic fertilizer	61.20 def	1.816 d	1588.53 d	42.37 abc	162.2 d	2.12 de	0.40 cd
	Bio-fertilizer	70.23cde	1.727 de	3278.34 b	42.30 abc	170.7 b	2.22 bcd	0.43 cd
	Liquid organic fertilizer + bio-fertilizer	79.87 bcd	1.859 d	3333.21 b	50.47 ab	181.1 a	2.32 abc	0.49 b
means of fertilizers	control	58.90 c	1.188 c	694.20 c	27.11 b	141.2 d	1.27 d	0.32 d
	Liquid organic fertilizer	70.60 b	2.100 b	1433.65 b	32.05 b	158.5 c	2.07 c	0.41 c
	Bio-fertilizer	80.11 ab	2.130 b	2717.14 a	41.58 ab	167.3 b	2.18 b	0.43 b
	Liquid organic fertilizer + bio-fertilizer	85.61a	2.668 a	2442.59 a	48.60 a	180.4 a	2.38 a	0.52 a
means of varieties	Local	67.82 b	1.768 b	2818.49 a	42.83 a	159.3 b	1.99 a	0.42 a
	Barbarian	89.73 a	2.714 a	336.52 c	26.93 b	160.0 b	1.92 a	0.42 a
	Anaheim	63.88 b	1.582 c	2309.92 b	41.48 a	166.2 a	2.00 a	0.41 a

Resources

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