



RESPONSE OF THREE CULTIVARS OF EGGPLANT TO SPRAYING WITH ORGANIC EXTRACTS IN GROWTH AND YIELD INDICATORS

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Abstract

This study was conducted in one of the agricultural fields in Babylon province, AbiGharaq district for the agriculture season 2019, To know the response of three cultivars of eggplant to spray with organic extracts in growth indicators obtained Individually or interacting at the average of three sprayings of the first spraying had the plant reaching the four real leaves stage while the second spray was at the beginning of flowering and the third spraying two weeks after the second spraying and the first factor represented three Eggplant cultivars (local cultivar, black beauty, Hazzard hybrid) and placed within the main plots and the second factor is four treatments of organic extracts (spraying with distilled water and spraying with the Ceratophyllum plant extract at a concentration of 20 ml.L⁻¹ and spraying with an Acadian stimulate at a concentration of 1.50 g.L⁻¹ and The interaction between the Ceratophyllum extract (10 ml.L⁻¹ + and the Acadian stimulate 0.75 g.L⁻¹) the concentrations of organic extracts were placed on the subplots and the results were analyzed according to the split-plot design. The results showed the significant effect of the study factors on all the studied traits in the experiment, where the combination (Black beauty + (10 ml.L⁻¹ + Acadian 0.75 g.L⁻¹) achieved the highest average in the traits of plant height and number of leaves, While the combination (Hazzard + (10 ml.L⁻¹ + Acadian 0.75 g.L⁻¹) excelled it recorded the highest average in the traits of the percentage of flowers set and the total yield of the plant and the fruit content of vitamin C and the leaf content of nutrients (K, P, N), Compared to the control treatment.

Key words: Eggplant, organic extracts, growth and yield indicator.

Introduction

Eggplant (*Solanum melongena* L.) is one of the main summer vegetable crops in Iraq and belongs to the Solanaceae family. The *Solanum* eggplant genus contains more than a thousand plant species and 75 genera (Mohammadi, 1990). The central regions of India and southeast China are the original country of eggplant and from there moved to Asia Minor, Egypt and many different countries of the world (Boras *et al.*, 2011). Eggplant is an important summer vegetable crop due to the increasing demand for it and the absorption of markets for all its quantities offered throughout the year, in addition to its good economic returns for its producers. The total area cultivated with eggplant in the world is 1864556 hectares. 6307 hectares and the total production amounted to about 113699 thousand tons . (Gopalan *et al.*, 2007) showed that the fruits of eggplant are of great nutritional importance as they are eaten after cooking, entering into the manufacture of pickles, preserving by freezing or canned for the purpose of exporting and that this fruit has a high nutritional value due to its many carbohydrate

compounds, proteins, fats, fiber and vitamins (A , B, C and some mineral salts (K, P, Mg, Ca, Na, Fe, Zn) and calories. It is also of medical importance where it is useful for treating asthma, diabetes, dysuria, cholera, severe diarrhea, lowering blood cholesterol and treating liver disease (Kashyap *et al.*, 2003). As for the cultivars, they are considered one of the most important factors that determine productivity, where the cultivars are generally governed by genetic and environmental interaction and genetic factors that determine the degree of growth and development of the organism, so the genetic nature of the cultivated cultivars greatly affects the quantity and quality of the crop (AL-Shmary and AL-Taey, 2020.). Many hybrid cultivars are grown in Iraq, which are characterized by their productive specifications and good quality, including Blackbuty and Hazzard cultivars , as well as local varieties that are found in most agricultural lands (Al-Shammari, 2008). In a study conducted by Khazaol and Rashed (2018) on the effect of eggplant cultivars (Paris, Sevilla, Barcelona) and spraying with different concentrations of seaweed extract (0, 0, 75, 1)

ml.L⁻¹ and their interaction in the growth and yield of the eggplant plant as they showed Results significantly excelled the Paris cultivars in all traits of vegetative growth, nutritional content and yield. seaweed extract increases the ability of vegetative growth and root system of the plant, as well as the quantity and quality of the crop and the delay in the entry of fruits into the senescence stage, in addition to its resistance to biological and abiotic stress (Stirk *et al.*, 2003).

Nutrients is the most important processes of the service of the crop and the important means of production for its impact in the organization of plant physiological processes, especially nutrition of macro nutrients (Al-Taey and AL-Musawi 2019; AL-Bayati, *et al.*, 2019).

Phytohormones are considered the most important endogenous substances for modulating physiological and molecular responses, a critical requirement for plant survival as sessile organisms, Phytohormones act either at their site of synthesis or elsewhere in plants following their transport (AL-Taey and Saadon, 2014).

Seaweed extracts contain many macro and micronutrients and some growth regulators and amino acids that have a role in improving vegetative growth and root system of the plant as well as to their role in increasing component absorption, increased activity, and disease resistance (Hasan *et al.*, 2019). Among these extracts are the *Ceratophyllum* and Acadian, as the *Ceratophyllum demersum* is an important aquatic plant that is classified as a submersible aquatic plant (Anning and Yeboah-Gyan 2007). Studies have shown the positive role of these extracts in improving the traits of growth, yield and seed germination (Alzobaie and Al-Nuaimi, 2009) and in a study conducted by the Khabar (2019) of the effect of spraying with the extract of the *Ceratophyllum* plant in three concentrations (0, 10, 20) ml.L⁻¹ and three spraying on the vegetable growth. For green pods of beans, there was a significant excelled in the treatment of spraying with the extract of the *Ceratophyllum* plant at a concentration of (20) ml.L⁻¹ in most vegetable indicators and yield. This study aims to demonstrate the effect of *Ceratophyllum* extract and Acadian stimulant on the traits of vegetative and nutritional growth of eggplant, experimenting with the cultivation of modern cultivars and the extent of their success in the region.

Materials and methods

This experiment was conducted in one of the agricultural fields in Babylon province, AbiGharaq district, On three cultivars with sprayed eggplant plant with the extract of the *Ceratophyllum* plant, which contains in its composition the macronutrients, plant hormones, amino

acids and vitamins with a concentration of 20 ml.L⁻¹ and Acadian containing in combination with amino acids and some nutrients and minerals in addition to Mannitol at a concentration of 1.50 g.L⁻¹ and the interaction between the *Ceratophyllum* extract (10 ml.L⁻¹ + Acadian 0.75 g.L⁻¹), In addition to the control treatment, at the average of three sprayings, the first spraying had the plant reaching the four real leaves stage, while the second spraying was at the beginning of flowering and the third spraying two weeks after the second spraying and a diffuse substance (liquid soap) was added at an average of (0.01) ml.L⁻¹ to extracts to reduce surface tension. A 20-liter manual sprayer was used for early morning spraying until the plants were completely wetness (Al-Sahaf, 1989). The experiment included 12 treatments of the first factor, which is the compatibility between three cultivars of eggplant (the local cultivars and the black beauty and Hazzard cultivar) whose symbol is A1, A2 and A3) respectively, where the cultivars were placed on the main plots, while the second factor, there are four treatments of organic extracts (spraying with distilled water B1 and spraying with the extract of the *Ceratophyllum* plant at a concentration of 20 ml.L⁻¹ B2 and the Acadian stimulant at a concentration of 1.50 g.L⁻¹ B3 and the interaction between the *Ceratophyllum* extract (10 ml.L⁻¹ + Acadian 0.75 g.L⁻¹ B4) concentrations of organic extracts were placed on the subplots, with three replicates per treatment, and the experimental unit included 10 seedlings. The split-plot design was used and the averages were compared using the least significant difference (LSD) at the probability level of 0.05 using (Genstat discovery program), After performing the treatments, the following measurements were taken: - plant height (cm): The height of the main stem was taken from the soil surface level to the highest to the top of the plant by the tape measure (Patton, 1984). Total number of leaves (leaf.plant⁻¹): according to the number of leaves of five plants from each experimental unit randomly and according to the average number of leaves per plant. Percentage of fruits set: - They are calculated according to the following formula. Percentage of contracting flowers = number of fruits * 100/total number of flowers. Quantity of the total yield of the unit area (ton.ha⁻¹) according to the total yield of each experimental unit from the first harvest until the last harvest in a combined form of the experimental unit yield 5 m² according to the following equations: the experimental unit yield = the plant yield = the number of plants in the experimental unit and the total yield (ton.ha⁻¹) = the yield of the experimental unit x the area of the hectare (10,000 square meters) / the area of the experimental unit m². Fruit content of vitamin C (mg. 100 ml juice⁻¹) Vitamin C was determined according to

the color method. Percentage of nitrogen in leaves (%) Determine nitrogen by using the Kjeldahl device. Percentage of phosphorus in leaves (%) The phosphorous element was estimated using a Spectrophotometer at 620 nm wavelength. Percentage of potassium in leaves (%) Determine the leaf content of potassium by flame photometer after preparing a series of standard potassium concentrations.

Results and Discussion

The results in table 2 showed the significant effect of the two factors of the experiment, The cultivars of eggplant (local, beauty Black, Hazzard) and organic extracts and their interaction in all the traits of the vegetative and nutritional growth of the eggplant, As the beauty black cultivar significantly excelled on the other cultivars in the two traits of the plant height and the number of total leaves as it gave the highest plant height 116.39 cm and the highest number of leaves reached 103.11 leaves.plant⁻¹ compared to the cultivar Hazzard which gave the lowest average. Whereas, Hazzard cultivar significantly increased in all other studied traits, which are the percentage of flowers set, the total yield, the leaf content of the nutrition elements (NPK) and the fruit content of vitamin C, which amounted to (66.90%, 100.20 tons. ha⁻¹, 22.45 mg. 100 ml juice⁻¹, 1.89%, 0.24%, 2.21%) respectively, compared with the local cultivar, which recorded the lowest average. It is also clear from the above table the significant effect of organic extracts on the mentioned traits where the treatment (Ceratophyllum plant 10 ml. L⁻¹ + Acadian) 0.75 g. L⁻¹) was significantly excelled in achieving the highest average in plant height, the number of total leaves and the leaf content of nutrients (NPK and that amounted to (106.99 cm, 106.09 leaf.plant⁻¹, 2.55%, 0.35%, 2.68%) respectively compared to the control treatment, The treatment spraying with the Ceratophyllum extract at a concentration of 20

ml.L⁻¹ showed significant differences in the percentage of the flowers set, the total yield of the plant and the fruit content of vitamin C, which amounted to (67.60%, 108.65 tons.ha⁻¹, 23.41 mg. 100ml juice⁻¹) on respectively, compared to plants sprayed with distilled water, the lowest average were recorded. As for the interaction between the three cultivars and the organic extracts, the above table showed a significant excelled when treating (beauty black cultivar with the extract of the Ceratophyllum plant at a concentration of 10ml.L⁻¹ + acadian in a concentration of 0.75g.L⁻¹) on the rest of the treatments in the plant height, The number of leaves and the percentage of phosphorus in the leaves, which amounted to (122.10 cm, 112.56 leaf.plant⁻¹, 0.40%) respectively compared to the control treatment that gave the lowest average, The treatment of the interaction between (Hazzard cultivar with the Ceratophyllum plant extract at a concentration of 10ml.L⁻¹ + Acadian in a concentration of 0.75g.L⁻¹) showed significant differences in the traits of the percentage of the flowers set, the total yield and the leaf content of nitrogen and potassium and the fruit content of vitamin C which amounted to (72.14 %, 122.54 tons.ha⁻¹, 25.27 mg. 100 ml juice⁻¹, 2.77%, 3.10%) respectively, compared with plants treated with distilled water which recorded the lowest average.

The results show that the cultivar has a significant excelled effect in the vegetative growth indicators, table 2 (plant height, number of leaves). Perhaps the reason for the significant increase of the beauty black cultivar on the rest of the cultivars is due to the presence of the phenomenon of hybrid vigour of this cultivar and the homogeneity of plant growth in the field as well as an increase Table of nitrogen percentage in leaves is table 2 and then it is reflected in the increase in chlorophyll percentage and then the increase in vegetative growth (Jassem and Saadoun, 2012). This is what (Abdul Rahman *et al.*, 2019) reached from his study on eggplant

Treatment symbol	Treatments	No.
T1	Local cultivar + organic extract concentration 0 ml. L ⁻¹	1
T2	Local cultivar + Ceratophyllum extract 20 ml.L ⁻¹	2
T3	Local cultivar + Acadian 1.50 g.L ⁻¹	3
T4	Local cultivar + interaction between Ceratophyllum extract 10 ml. L ⁻¹ + Acadian stimulant 0.75g.L ⁻¹	4
T5	Black beauty cultivar + organic extract concentration 0 ml. L ⁻¹	5
T6	Black beauty cultivar + Ceratophyllum extract 20 ml.L ⁻¹	6
T7	Black beauty cultivar + Acadian stimulant 1.50g.L ⁻¹	7
T8	Black beauty cultivar + interaction between Ceratophyllum extract 10 ml.L ⁻¹ + Acadian 0.75g / 11	8
T9	Hazzard cultivar + Organic extract Concentrate - 0 ml.L ⁻¹	9
T10	Hazzard cultivar + Ceratophyllum extract 20 ml.L ⁻¹	10
T11	Hazzard cultivar + Acadian stimulant 1.50 g.L ⁻¹	11
T12	Hazzard cultivar + interaction between Ceratophyllum extract 10 ml.L ⁻¹ + Acadian 0.75 g.L ⁻¹	12

in the indicators of vegetative growth and the reason for this increase is due to the variation of the genetic factors of the cultivars and responsible for the quantitative and qualitative traits of the eggplant plant. Also, the reason for the excelled of the cultivar (Hazzard) in the indicators obtained in the above table (percentage of flowers set, and the total yield) may be due to the genetic traits, and then the cultivars in this traits are suitable for environmental conditions (Adai and Hamad, 2017). These results are consistent with (Novella *et al.*, 2008) on potato plants the reason for increasing the yield is due to the genotype of the cultivar (Hazzard) and the suitability of the cultivar for the environmental conditions of the region (Al-Hayani, 2000) Or perhaps the reason for the significantly excelled of the cultivars is due to the genetic nature of the cultivar that is characterized by an increase in the number of flowers set and then the increase in the number of fruits and the yield of one plant that was reflected on the Increased total yield (Jassem and Saadoun, 2012). As for the excelled of the Hazzard cultivar in the significant increase in the leaf content of the nutrition elements NPK) and their vitamin C content, this difference between the cultivars may be due to the

genetic nature of the cultivars in their ability to absorb nutrients (N, P, K) (Al-Sahaf, 1989) as The reason for the variation of cultivars in the percentage of vitamin C in the fruits can be due to the strength of the genetic factor of the hybrid (Hazzard) (Iqbal *et al.*, 1995) and these results are consistent with (Jassem and Saadoun, 2012) on three cultivars of eggplant and the excelled of the Barcelona cultivar in increasing the content of leaves Vitamin C and NPK nutrient, As for organic extracts, the significant increase in the traits of vegetative growth and the nutrition content of the eggplant plant represented by plant height, a number of leaves, and the percentage of nutrients (N, P, K) in the leaves can be explained in table 2 by the effect of spraying with organic extracts to the role of these extracts In-plant physiological processes in the construction of chlorophyll and organic compounds, these extracts may play as an antioxidant (Spinelli *et al.*, 2009). Perhaps it is due to that this extract contains plant-like hormones such as Auxin and cytokinins and substances that encourage growth such as amino acids, proteins and vitamins that have a role in encouraging cell division and elongation, which has stimulated increased and efficiency of the carbon representation process and

Table 2: Effect of cultivar and spraying with the *Ceratophyllum* plant and Acadian extracts and their interaction on the traits of vegetative growth and the nutritional content of eggplant.

Treatments	Percentage of potassium in leaves (%)	Percentage of phosphorus in leaves (%)	Percentage of nitrogen in leaves (%)	Fruit content of vitamin C (mg. 100 ml juice-1)	The total yield (ton.ha ⁻¹)	Percentage of fruits set (%)	Total number of leaves (leaf. plant ⁻¹)	plant height (cm)
T1	1.08	0.11	0.68	18.22	52.14	53.78	92.21	102.63
T2	1.81	0.21	1.63	22.11	96.36	63.36	101.21	113.11
T3	1.98	0.17	1.28	20.12	67.63	59.69	95.36	107.72
T4	2.16	0.31	2.33	21.42	84.59	64.88	107.16	113.52
T5	1.86	0.13	0.79	18.54	55.44	55.65	93.37	110.75
T6	1.87	0.22	2.16	23.25	110.65	67.36	107.16	118.36
T7	2.09	0.18	1.37	20.25	71.28	63.92	99.36	114.35
T8	2.78	0.40	2.54	22.54	96.82	65.33	112.56	122.10
T9	1.90	0.16	0.97	18.69	62.48	57.55	83.16	73.70
T10	1.97	0.24	2.19	24.87	118.94	72.06	92.83	82.17
T11	1.89	0.20	1.61	20.97	96.82	65.85	90.07	79.75
T12	3.10	0.34	2.77	25.27	122.54	72.14	98.54	85.36
LSDAB	0.757	0.015	0.318	0.378	3.770	0.892	1.124	0.779
The average concentration of extracts	1.61	0.13	0.81	18.48	56.69	55.66	89.58	95.69
	1.88	0.22	1.99	23.41	108.65	67.60	100.40	104.55
	1.98	0.18	1.42	20.45	78.58	63.15	94.93	100.61
	2.68	0.35	2.55	23.08	101.32	67.45	106.09	106.99
LSD B	0.437	0.008	0.184	0.218	2.177	0.515	0.649	0.449
The average of cultivars	1.76	0.20	1.48	20.47	75.18	60.43	98.99	109.25
	2.15	0.23	1.72	21.15	83.55	63.07	103.11	116.39
	2.21	0.24	1.88	22.40	100.20	66.90	91.15	80.20
LSD A	0.447	0.004	0.198	0.207	2.624	0.670	1.252	3.944

thus improved the vegetative growth of the Osman *et al.*, (2010). As for the increased leaf content of nutrients (N, P, K) as a result of spraying with this extract, it can be due to the presence of amino acids in organic extracts, which have a physiological role in changing the osmotic potential within plant tissues, It reduces the water potential, which increases the cell's ability to absorb water and dissolved nutrients in it, and this is reflected positively in the plant growth Amini and Ehsanpour (2005). This has been reflected in the overall increase in the leaf content of these nutrients. These results are consistent with (El-Desouky *et al.*, 2011) on tomato plants. The reason for the significant increase in the indicators of the vegetative growth (plant height, number of leaves) is due to the content of these extracts from the macronutrients (N.P.K.) as nitrogen has a fundamental role in building many important organic compounds in physiological processes within the plant, It is involved in building the chlorophyll pigment, nucleic acids (DNA, RNA), proteins, hormones and enzymes involved in the process of building the protoplasm as well as it has a role in building important cytochromes in respiration and photosynthesis processes (Al-Sahaf, 1989) and then increasing the plant's susceptibility to food production by the synthesis process. The photosynthesis, which in turn is reflected in the increase in the average of vegetative growth and these results are consistent with (Zdrarkovic *et al.*, 2008) and (Khabar, 2019) on the Bean. The reason for the higher percentage of flowers set and the total yield of eggplant and the fruit content of vitamin C may be due to the content of the Ceratophyllum extract from the nutrition elements. When spraying with the extract containing those elements, the accumulation and absorption of the leaves increases, including the nitrogen component, and by increasing it the volume of vegetative growth increases, which in turn is reflected in the increase in food plant in leaves and reach a state of balance between nitrogen carbohydrates (C/N), Which encourages the growth of flowers and their set to the role of phosphorus, because it is of great importance in vital activities, which affects flowers, and consequently the percentage of the set and the increase in yield (Young and Lee, 2005). These results are consistent (Yousif, 2011) also indicated on the cucumber plant. The reason is due to that organic extracts contain many growth regulators (Auxin, Cytokinins and Gibberellin) that play an important role in plant growth and development, increase the speed of cell division and elongation, and form leaf principles as well as the role that Auxin plays in increasing flowering average and forming of pollen. The vaccine increases the percentage of the and these results are consistent with (Al-Saadi *et*

al., 2016) when spraying gibberellin to the *Pisum sativum* L.

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