Evaluating seeds content of some cultivars of sunflower from oil and elements by the effect of spraying and adding humic acid

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Abstract

The research included an evaluation study of the content of four sunflower cultivars of major elements, vegetative growth and seed oil content. The results showed significant increases in vegetative growth (dry weight and leaf area) by the effect of spraying and/or ground addition of humic acid and the effect of different cultivars and combinations. The spraying and adding treatment showed significant increases of 58% and 29%, respectively, while Zahrat Al-Iraq excelled in dry weight and Quds cultivar in leaf area with different percentages of excelled .The cultivar Quds caused a significant increase in the nitrogen content of the seeds by more than 37%. Humic acid treatment had no significant effect. Whereas, all humic acid treatments caused significant increases in phosphorous that reached a maximum when using the (ground addition) treatment, at an average of more than 38%. with regard to the oil content of the seeds, a significant increase was obtained for the treatment of (foliar spray) by approximately 3%.While the cultivars caused significant increases for this trait and for all cultivars, they reached a maximum in the cultivar (French) with an increase of approximately 27%. With regard to the combinations, significant increases occurred for most of them, reaching a maximum in the combination (adding ground x French) with an increase rate of more than 40%.

Introduction

The sunflower crop (*Helianthus annuus* L.) is one of the important oil crops and comes in second place after soybean for the most traded oil crops in the global commercial markets. It is distinguished by its good taste and taste, so it is used in the food industry such as the edible oil industry, the soap industry, and high-quality fats, as well as its earnings on It is high in protein, carbohydrates and oils, which is a good animal feed [8].The crop is grown for the purpose of obtaining seeds that contain a percentage ranging between 35-55% of the oil that is used for food purposes. The need for sunflower oil is very important because it contains unsaturated fatty acids that are important in terms of health compared to hydrogenated animal and vegetable fats. In addition to the Omega oils, Omega 3 and Omega 6, which support the immune system of the human body, and their lack of food

ISSN 2072-3875

leads to heart attacks, As well as containing vitamins A, B and D, which play an important role in preventing its oxidation on the one hand and the health importance of the consumer on the other hand, making it one of the best vegetable oils to be consumed at the global level [14]. The productivity of the oil crop varies according to the service factors and the genotypes and their interactions. For the purpose of increasing production and improving quality, this had to be taken into account [9].In recent years, the importance of humic acid has emerged. Adding it as a spray to the plant has improved growth and yield. Many researches have proven that foliar nitration with humic acid reduced the amount of chemical fertilizers added to the soil, which leads to a reduction in cost and pollution with those fertilizers without affecting the amount of yield with no harmful effect on the environment. Humic foliar fertilization increases the plant's ability to retain water, photosynthesis, and photosynthesis antioxidants, as humic acid contains a number of nutrients such as organic compounds that help increase plant growth and development [8]. Humic acid is harmless to humans, plants and the environment. It has a physiological importance for plants and a physical, chemical and biological importance for the soil. It activates cell division and elongation.It also works to improve the chemical properties of the soil by increasing the availability content of nutritional elements and increasing the absorption of nitrogen, calcium, magnesium and phosphorous elements essential to feeding the crop by making it more available. Hence, the crop grows in a fertile and suitable environment for it and thus will affect the oil content of the plant

Materials and methods:

1. The experiment location.

A field experiment was conducted in the field belonging to the Department of Field Crops, College of Agriculture - Al-Qasim Green University during the spring season of 2021 to know the effect of humic acid treatments and four cultivars of sunflower crop.

2. The seeds.

The seeds of four sunflower cultivars were obtained from the General Commission for Agricultural Research / Baghdad. The cultivars were Argentine, Iraq Flower, Jerusalem and French.

3. Field experiment design.

A field experiment was conducted according to the RCBD (Randomized Complete Block Design) as a factorial experiment with three replications, each replicate included 16 experimental units.

4. experiment factors.

1. Humic acid: a. control b. Foliar spray c. Ground addition d. spraying and adding

ISSN 2072-3875

2. cultivars : a. Argentine b. Iraq flower c. Jerusalem d. French .

5. Preparation of humic acid.

A ppm of 3000 ppm recommended with a volume of 2 litres was prepared for each experimental unit concerned with spray treatment, spraying and addiction treatment, and when the plants reached the stage of 50% flowering,The plants were sprayed with humic acid and the ground addition was done by adding a certain weight of acid salt, which expresses the same concentration of spray treatment for each experimental unit in the concerned experimental units by adding and then irrigating it to accelerate the dissolution of this substance. As for the interaction of spraying with the ground addition, spraying and addition were conducted at the same time and with the same values expressed for the experiment units concerned with the interaction While the control treatment was irrigated with water only for the purpose of control. The seeds were planted in Goura and in the furrow method, the distance between one pit and another was 40 cm, and between one and another 1 m.

Vegetative traits measurements.

Ten plants were identified for each experimental unit to perform the following measurements:

1. Dry weight:

The leaves of the ten plants were dried using an electric dryer at a temperature of 70 0 C for three days until the weight was stable. Then the dry weight was measured using a sensitive scale.

2. leaves area:

The maximum length and maximum width were measured using a tape measure for the leaves of the ten predetermined plants, and the leaf area was calculated by applying the following relationship:

Paper area = maximum length x maximum width x 0.654 [1] .

Qualitative trait measures.

1. The percentage of oil per seeds.

The percentage of oil per seeds was estimated using the Oil Pressing Machine and according to the method used by [20].

After wet digestion of the dry matter of leaves and seeds using concentrated sulfuric acid H_2SO_4 and concentrated perchloric acid HClO4, their content of the following nutrients was measured:

2. The potassium element in the seeds.

Using the UK model Flam photometer, the samples were transferred to the device after it was directly calibrated for the determination of potassium.

3. The nitrogen element in the seeds.

ISSN 2072-3875

The nitrogen element was estimated by Kjeldahl apparatus based on [13].

4. The phosphorous element in the seeds.

The phosphorous element in seeds was estimated using ammonium molybdate and ascorbic acid using a spectrophotometer and according to the method described in [13].

Results and discussion :

1. Dry weight of leaves:

Table (1) showed that humic acid treatments caused different significant increases that reached their maximum when spraying and adding a significant increase of 58%, and it reached at that treatment to 248.3 g compared to the control treatment which was 156.6 g .with regard to the cultivar treatments, we note from the same table that there was a significant increase in the cultivar Zahrat al-Iraq in this trait, where the percentage increase in the dry weight was maximum for the cultivar Zahrat al-Iraq, which reached 223.7 g compared to the control, which was 190.3 gm. The data indicated that there were significant differences in the number of mixtures compared to the control, which reached a maximum when the combination (spray and add x Zahrat al-Iraq) with a significant increase of 172% at this combination, it reached 328.0 g compared to the control treatment, which was 120.4 g dry weight.

Table (1) The effect of humic acid and its varieties and their interaction on the dry weight of sunflower leaves (g).

humic acid	Cultivars				Average
	French	Quds	Zahrat Al-Iraq	Argentinian	
Control	129.9	194.6	181.3	120.4	156.6
foliar spraying	195.4	124.6	183.4	288.6	198.0
ground adding	141.0	148.6	202.0	184.4	169.0
ground adding+foliar spraying	236.0	261.0	328.0	168.0	248.3
Average	175.6	182.2	223.7	190.3	
LSD 0.05		cultivar 21.75		Humic 21.75	humic x cultivar 43.50

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2. leaves area:

We notice from Table (2) that there were significant increases in the leaf area of sunflower and for all acid treatments, which reached a maximum at the parameter (spray and addition) by 28.9%, as it was at that treatment 215 cm^2 while it was in the control treatment 166.7 cm^2.As for the cultivars, there was a significant increase of the variety (Quds) on the cultivar (Argentine) by more than 46%, where the leaf area of the cultivar (Quds) was 218.1 cm^2 compared to the cultivar (Argentine) 149.0 cm^2.The same table showed that there were significant differences in the number of mixtures compared to the control, which reached a maximum in the combination (control x Quds), with a significant increase of 132%, as it reached at this combination 269.4 cm^2 compared to the control treatment, which was 116.1 cm^2.The reason for the significant differences in dry weight and leaf area may be due to the fact that humic acid is one of the biological stimulants that encourage the plant to increase the absorption of water and nutrients [7].Thus, cell division and elongation increase, and humic acid improves plant growth while participating in providing a good environment for the roots, which leads to an abundance of nutrients by increasing the amount of their absorption and transfer and stimulating all physiological processes as well as its role in increasing the activity of soil organisms [2], which leads to increased growth represented by leaf area and dry weight.

Table (2). Effect of humic and cultivars and the interaction between them on the leaf area of sunflower (cm^2).

humic acid	Cultivars				average
	French	Quds	Zahrat Al-Iraq	Argentinian	
control	194.1	269.4	218.5	116.1	199.5
foliar spraying	238.1	192.3	220.8	164.2	203.9
ground adding	142.9	161.6	198.2	163.9	166.7
ground adding+foliar spraying	256.2	249.1	203.1	151.5	215.0
Average	207.8	218.1	210.1	149.0	
LSD 0.05		cultivar 19.81	Humic 19.81		humic x cultivar 39.62

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seeds content of Nitrogen :

Table (3) shows that there was no significant effect on the content of sunflower seeds for all humic acid treatments. While all cultivars caused significant increases in the sunflower seeds' content of nitrogen, the increase reached the maximum in the cultivar (Quds), with a percentage exceeding 37%. The percentage for the cultivar (Quds) reached 3.72% compared to the control treatment (Argentine) which was 2.71%. With regard to the interactions that occurred between the acid treatments and the different varieties, a number of significantly excelled appeared, and for a number of those combinations, they reached their maximum with the two combinations (adding ground x Iraq flower) and (spraying and adding x Quds), with an increased rate of more than 51% for both combinations.

Table (3) Effect of humic acid and cultivars and the interaction between them on the sunflower seeds content of nitrogen (%).

humic acid	Cultivars				average
	French	Quds	Zahrat Al-Iraq	Argentinian	
Control	3.57	3.67	3.04	2.62	3.23
foliar spraying	3.50	3.50	3.85	3.11	3.49
ground adding	3.39	3.74	3.95	2.80	3.47
ground adding+foliar spraying	3.39	3.95	3.85	2.32	3.38
Average	3.46	3.72	3.67	2.71	
LSD 0.05		Cultivar 0.37	Humic 0.37		humic x cultivar 0.74

4. seed's content of Potassium :

The data in Table (4) indicate a significant decrease for all humic acid treatments in the potassium content of sunflower seeds. The decrease was below compared to the treatment (spray and ground addition), with a decrease of more than 31%.When that treatment (spray and ground addition) reached 2.95 mg.g-1, while it was

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4.29 mg.g-1 when the control treatment, and what happened to humic acid treatments also happened to treatments of different cultivars, and the decrease reached the lowest when the (French) treatment and by A decrease of more than 14%, reaching 3.46 $mg.g^{-1}$, while it was 4.03 $mg.g^{-1}$ when the control treatment. With regard to the combinations obtained for these treatments, the potassium content of the seeds was disturbed between significant and insignificant increases and decreases, according to the quality of those combinations.The maximum significant increase was obtained when the two combinations (French x control) and (French x control) with an increase of 19% and 8%, respectively if they reached 4.90 mg.g-1 and 4.40 $mg.g^{-1}$, respectively, while it was 4.10 $mg.g^{-1}$ when control treatment, While the lowest decrease was in the combination (spraying and adding ground x French) and by more than 51%, which reached this combination 2.00 $mg.g^{-1}$ Whereas, it was 4.10 $mg.g^{-1}$ when the control treatment.

Table (4) The effect of humic acid and its cultivars and their interaction on the content of sunflower seeds potassium (mg.g-1).

humic acid	Cultivars				average
	French	Quds	Zahrat Al-Iraq	Argentinian	
Control	4.90	4.40	3.77	4.10	4.29
foliar spraying	3.20	3.23	3.20	4.20	3.46
ground adding	3.73	3.70	3.80	4.20	386
ground adding+foliar spraying	2.00	3.00	3.20	3.60	2.95
Average	3.46	3.58	3.49	4.03	
LSD 0.05		Cultivar 0.18		Humic 0.18	humic x cultivar 0.36

The seed content of the element phosphorous.

It is evident from the data in Table (5) that there was a significantly excelled for all humic acid treatments in the phosphorous content of sunflower seeds, and the maximum increase was when the (ground addition) treatment was at an average of more than 38% approximately, it amounted to 0.688% when

ISSN 2072-3875

the (ground addition) treatment was conducted. With the control treatment which was 0.498 %,While the two cultivars (Quds) and (French) showed two significant increases, the maximum of which was in the (French) cultivar with an increase of approximately 18%, which was 0.687% compared to the control treatment (Argentine), which was 0.583%,With regard to the combinations obtained for these treatments, most of the combinations showed different increases, reaching their maximum in the combination (spray and add x Quds) with an increase rate of 83% if it was about 0.803% when compared to the control treatment (Argentine) which was 0.438%.

Table (5) Effect of humic acid and cultivars and the interaction between them on the phosphorous content of sunflower seeds (%).

humic acid	Cultivars				average
	French	Quds	Zahrat Al-Iraq	Argentinian	
Control	0.662	0.426	0.466	0.438	0.498
foliar spraying	0.770	0.671	0.619	0.680	0.685
ground adding	0.657	0.699	0.691	0.706	0.688
ground adding+foliar spraying	0.660	0.803	0.694	0.506	0.666
Average	0.687	0.650	0.618	0.583	
LSD 0.05		Cultivar 0.041	Humic 0.041		humic x cultivar 0.082

We notice from Tables (3, 4, 5) significant increases in the seed content of nitrogen and phosphorous due to the role of humic acid and cultivars in providing suitable conditions for the absorption of these nutrients and their transfer from the soil to the leaves and then to the seeds [12],Humic acid also has a role in increasing the growth of the root system and thus increasing the amount of ready phosphorous absorption from the soil, and humic acid is one of the important sources that contain phosphorous and potassium [19].

ISSN 2072-3875

Humic acid increases the ability of the soil to retain water by providing a suitable environment for the reproduction and activity of the organisms in the processing of phosphorous through the possibility of this revival in extracting phosphorous from inorganic sources such as superphosphate, as well as secreting them as growth regulators that cause an increase in the absorption of other nutrients and lead to the preparation of the plant from The main nutrients, especially phosphorous, which has a major role in activating the process of carbon assimilation and its role in many other functional processes [10]. Humic acid, whether sprayed on plants or in addition to soil, increases the permeability of cellular membranes and stimulates enzymatic reactions. Spraying humic acid on plants, as a result of the amount of nutrients it contains, has achieved an increase in the nitrogen and phosphorous content of seeds in plants. This is consistent with [15] who indicated a significant increase in the percentage of nutrients in the leaves of plants when sprayed with humic acids compared to the control treatment without spraying. In general, humic acid spraying is an agricultural technique that promotes plant growth because it is an environmentally friendly method that stimulates soil revitalization, which increases the plant's ability to absorb water and nutrients.Reducing the effects of drought, salinity and pollution with heavy metals, leads to an increase in the efficiency and speed of photosynthesis and the production of dry matter, which is reflected in the dry weight of the plant in general and on the leaves and discs in particular, and this is what was noted by [6], [5] and [4] and [3] . With regard to the decrease in the content of seeds from the potassium element, it can be explained based on the principle of compensation. When a certain decrease occurs for a certain characteristic, it corresponds to a significant increase for another characteristic, as stated in the content of seeds from this element on the one hand and on the other hand, the element potassium does not participate in building any It is one of the important biological compounds in the structure and function of plants, but it acts as an activator of many different enzymatic systems [17].

6. The oil content of the seeds.

It is clear from the data in Table (6) that there was a significant effect of the treatment of (foliar spray) on the oil content of the seeds. The percentage increase was approximately 3%. It reached 44.12% in that treatment compared to the control treatment, which was 42.89%.While the cultivars caused significant increases for this trait and for all cultivars, it reached a maximum against the cultivar (French) with an increased rate of approximately 27%, as it reached 46.77% at the cultivar (French), while it was in the control treatment (Argentinean) 36.83%.With

ISSN 2072-3875

regard to the combinations, significant increases occurred for most of them, which reached their maximum when the combination (adding ground x French), with an increased average of more than 40%.It reached at that combination (adding ground x French) 49.1%, while it was at the control treatment 34.94%.

Table (6). Effect of humic acid and cultivars and the interaction between them on the oil content of sunflower seeds %.

humic acid	Cultivars				average
	French	Quds	Zahrat Al-Iraq	Argentinian	
Control	47.43	42.80	46.40	34.94	42.89
foliar spraying	46.73	47.07	43.60	39.09	44.12
ground adding	49.11	46.63	44.70	33.24	43.42
ground adding+foliar spraying	43.81	44.65	43.40	40.07	42.98
Average	46.77	45.29	44.52	36.83	
LSD 0.05		Cultivar 0.99	Humic 0.99		humic x cultivar 1.98

This could be due to the role of humic acid in increasing the efficiency of the photosynthesis process and its outputs such as oils, or to its role in increasing the absorption of phosphorous (Table 5), which supports an increase in energy units in the form of Adenosine Triphosphate (ATP) and an increase in the production of sugars as a result of an increase in the production of Glucose-6-Phosphate is the main compound in the production of amino acids and fatty acids and energy production through glycolysis reactions to prepare the vital reactions with the vital and essential Acetyl-CoA compound in the respiratory cycle Krebs Cycle for energy production and the metabolism of

ISSN 2072-3875

primary and secondary compounds, which enhances the vital and/or metabolic pathways for oil production. It may be the most important role of organic acid compounds and other components present with humic acid that led to increased cationic capacity and permeability of cell membranes [16]. The addition of humic acid has an important role in increasing the number of leaves and leaf area and its active role in stimulating and accumulating nutrients in the leaves, and increasing vitamins and amino acids [18], which is positively reflected in the increase in the plants' content of the percentage of oil, and this is consistent with what was reached [11].

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ISSN 2072-3875