Plant Archives Vol. 21, Supplement 1, 2021 pp. 887-890 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
doi link : https://doi.org/10.51470/PLANTARCHIVES.2021.v21.S1.137

EFFECT OF SPRAYING WITH IRON AND HUMIC ACID ON SOME GROWTH CHARACTERISTICS OF WHEAT PLANT *TRITICUM AESTIVUM. L*

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ABSTRACT

A field experiment was carried out to cultivate the wheat crop in one of the agricultural fields of Babil Governorate - Al Teeniya area during the winter season 2019-2020- to study the effect of adding iron and different levels of humic acid on the growth and yield of wheat in a mixture of alluvial soil. Different proportions of iron (0,4, 8)/1 ml liter and symbolized by the symbols F_0, F_1, F_2). The second factor includes different levels of humic acid, added in three levels, which are (0, 25, 50) kg.E-1 and denoted by the symbols H_0, H_1, H_2, respectively. Thus, the number of treatments became two treatments in three replications, so that the number of experimental units became 27 experimental units. The experiment was carried out within the complete randomized sectors (RCBD). Wheat seeds of type Ebaa 99 were sown in January 2019 at maturity, plant height, leaf area, chlorophyll index, number of branches, and after harvest, the results were as follows: 1- Iron (F_2) spraying treatment gave the highest significant increase in the values of all growth characteristics represented by plant height, leaf area, chlorophyll index, biological yield, 1,000 grain weight, and grain yield. 2-The treatment of (H_2), which is the addition of 50 $kg.h^{-1}$ of humic acid as a ground addition, gave the highest significant increase for all growth characteristics of the wheat yield from plant height, leaf area, chlorophyll index, biological yield, 1000 grain weight and grain yield. 3- The double-overlap treatment of study factors resulted in the highest significant increase for all growth characteristics and wheat yield (plant height, leaf area, chlorophyll index, biological yield, one thousand grains weight, and grain yield). 4-The treatment of the double interference of the treatment (F_2H_2) gave the highest percentage of organic matter in the soil after harvest and the highest concentration of iron in wheat plant leaves. 110.3 mg. Kg^{-1}. 5- The treatment of double-overlap with iron spraying and the addition of different levels of humic acid, especially when the treatment (F_2H_2) did not differ significantly and for all the studied traits including growth characteristics and nutrient concentrations in grains and soil after harvest from the treatment (F_2H_0).

Keywords **:** Humic acid, wheat, iron, sparing

Introduction

Iron is one of the important micronutrients in the growth and development of the plant due to its entry into insoluble structures inside the plant, as between Kirekby and Mengel (2001) that iron has two basic benefits in the vital processes of plants, the first is that it activates the oxidation and reduction enzymes in the chain of electron transfer in the respiratory process, and the second It helps build chlorophyll although it is not included in its composition. Also, it was found that iron participates in vital compounds such as Cytochromes that are involved in the processes of photosynthesis and active absorption, and that the plant needs iron in greater quantities than it needs for the rest of the micronutrients. Humic acid is one of the main components. Humus, which is one of the main components of organic matter in the soil, which is formed through the process of biological and chemical degradation of the bodies of dead animals and plants as a result of the activity of microorganisms (Anonymous, 2010). It is artificially extracted from the organic matter of the soil and has direct effects on plant growth, such as increasing the vegetative and root system of the plant, and increasing the absorption of elements such as nitrogen, potassium, phosphorous, magnesium and calcium by the plant, and humic acid is a stable compound in nature that has no risks to the environment and the plant.

Awad (2002) stated that humic acid increases the concentration of microorganisms in the rhizosphere that provide nutrients that support plant growth. Chen *et al*. (2004) showed that humic acid causes an increase in the fresh and dry weight of crops. In recent years, humic acid has been used as an organic fertilizer by spraying at low concentrations on plant leaves to accelerate growth and increase production (Zidane and Diop 2005).

Wheat is an annual plant of the grass family, and it produces grains that are complex in the form of ears, as these grains are the main food for many peoples of the world, only corn and rice compete in this area, as these grains share the food of humans on earth. Once a year and in some countries it is grown twice. Wheat has a wide variety of types, some of which are suitable for making bread and some of which are suitable for making pasta or pasta. Wheat is grown in many countries of the world by relying on rain water for irrigation, and in other countries it is grown by relying on intermediary irrigation. Young wheat plants are bright green in color, and look like vets. Therefore, the research was directed to achieve the following goals:

1- The effect of spraying with iron and levels of ground addition with humic acid on some indicators of growth and wheat yield.

2- The interfering effect of iron spraying and levels of addition of humic acid on the readiness of some nutrients for plants and in the soil.

Materials and Methods

The experiment was carried out in one of the private peasant farms in Babil Governorate - Al-Tania area during the winter season (2019-2020). The experiment site is characterized by a flat topography previously planted with wheat and yellow corn crops in a mixture sandy soil classified to a level under the great group Typic Torrifluvent and according to the modern American classification (2006, Soil survey staff). Where several samples of field soil were taken for a depth of (0-30) cm, soil samples were mixed and a composite sample was obtained from them. Soil samples were dried by air, then milled and sifted with a sieve with a diameter of 2 mm holes. These samples were used to estimate the physical and chemical properties of the field's soil, as shown below.

Table 1 : Physical properties of field soil before planting

Property	units	The value
Sand	g kg^{-1}	220
Silt		330
Clay		450
Soil texture		Sandy Loam
Bulk density	Mg m^{-3}	1.34
True density		2.64

Soil chemical properties before planting: the following chemical properties of soil were estimated as shown in table 2

Table 2 : Chemical properties of field soil before planting

Property	units	The value
EC	dSm^{-1}	3.79
pH		7.70
OM	g kg^{-1}	8.33
$CaCO_3$		220
CEC	Cmol+kg^{-1}	18.39
Gypsum	G kg^{-1}	85

Experiment parameters and statistical design.

The experiment included studying the impact of two factors:

The first factor - adding humic acid by ground fertilization method

H0 addition of 0 kg humic acid H^{-1} (measurement treatment)

H1: Addition of humic acid in an amount of 25 kg H^{-1}.

H2. Addition of 50 kg of humic acid to H^{-1}.

-The second factor - adding iron element by spraying the plant:

F0 Addition of elemental iron at 0 ml (measuring treatment)

F1: Add element iron to 4 mL

F2 Add element iron by 8 mL

Thus, the number of transactions became 3 x 3 = 9 treatments and in three iterations, so that the number of experimental units became 3 x 3 x 3 = 27 experimental units

Growth indicators:

1- Plant height (cm): The average plant height of ten plants in each experimental unit was measured using a tape measure from the soil surface level to the bottom end of the main stem spike according to Donaldson (1996).

2- Number of branches : The number of spike-bearing branches was calculated as an average of ten plants per experimental unit.

3- Flag Sheet Area (cm^2) : It was measured as an average of ten science papers for the main stems of each experimental unit according to the following equation:

Flag Sheet Area = Flag Sheet Length x Width at Center x 0.95.

Statistical analysis :

After obtaining the trial data, it was analyzed statistically according to the design of complete randomized sectors, and the averages were compared using the L.S.D (at 0.05 significance level) using the Genstat program (Narrator and Muhammad, 1990).

Results and Discussion

Plant height (cm)

The results of statistical analysis in Table (3) indicated the existence of an effect of spraying with iron and the addition of ground humic acid and its interference in the characteristic of the height of the wheat plant (cm). Iron spraying had a content effect in increasing the plant height (cm). The value of which amounted to (102.65) cm compared to the coefficients of (f0, f1) whose value amounted to 93.54.96.61 cm and showed an increase of 9.7.6.25% for each of them sequentially as it is noticed in the table that the effect of ground addition of humic acid had a significant effect on the characteristic of plant height, even higher Its value was at the treatment H2 whose value was (102.44) cm, compared to the two treatments H0 and H1, which amounted to (99.08), (91.28) cm, and the structure of an increase of 12.22%, 3.39 for each of them respectively, as for the effect of the interference between spraying with iron element and humic acid levels. It also had a significant effect on the height of the wheat plant (cm), and that its highest value was when the double interference treatment F2H2, which reached a value of 110.H cm, which did not differ significantly from the interaction treatment F2H1, which reached a value of 105.60 cm, and that the lowest value was when the double interference treatment F0H0, which reached Its value is 9 0.14 cm and the structure an increase of 22.22%

Table 3 : The effect of iron spraying, ground addition of humic acid and the overlap between them on wheat plant height (cm).

Ground spray	F0	F1	F2	average
H0	90.14	91.50	92.20	91.28
H1	93.33	98.33	105.60	99.08
H2	97.16	100.00	110.17	102.44
average	93.54	96.61	102.65	
L.S.D(0.05)	4	H	F*H	
	0.63	0.63	1.25	

Paper area (cm^2)

The results of the statistical analysis in Table (5) indicated that the effect of spraying with the element of iron and the addition of different levels of humic acid had a significant effect on the characteristic of the leaf area of the wheat plant (cm^2). It is noticed from the table that the spraying with the element of iron had a significant effect in increasing the characteristic of the leaf area (cm^2). The highest value was when spraying F2, whose value was (52.38 cm^2), compared to two treatments F0, F1, which had a value of 40.65, 43.50 cm^2, with an increase of 28.79, 20.41% for each of the results, as the addition of different levels of humic acid increased the area The paper (cm^2) and the highest value for this characteristic was at treatment H2, which amounted to 51.37 cm^2, compared to the parameters of H0, H1, which amounted to 38.81,46.37 cm^2, with an increase of 32.36,10.78% for each of the results, as it is noted in the same table that the effect of interference between spraying With iron component, the addition of different levels of humic acid had a significant effect on increasing the leaf area (cm^2) of the wheat plant, and the highest value of it was when the F2H2 treatment, whose value was 63.25 cm^2, did not differ significantly from the F2H1 double interference treatment, which reached the value of Its value is 53.61 cm^2, and the lowest value of the leaf area of wheat plant (cm^2) was compared to the (comparison) interaction treatment F0H0, which amounted to 3750 cm^2, with an increase over the two interference factors F2H1 and F 2H2, which reached 68.66, 42.96% for each, respectively.

Table 4 : The effect of iron spraying, ground addition of humic acid levels and the overlap between them on leafy sprouts (cm^2)

Paper area (cm^2)	F0	F1	F2	average
H0	73.50	38.66	40.29	38.81
H1	41.20	44.30	53.61	46.37
H2	43.33	47.55	63.25	51.37
average	40.67	43.50	52.38	
L.S.D(0.05)	F	H	F*H	
	0.33	0.33	1.80	

The branches

The results of the statistical analysis in Table (5) showed that the effect of spraying with iron component and the ground addition of humic acid levels and their interference had a significant effect on the number of branches of the wheat plant if it was noticed from the table that the effect of spraying with the iron component had a significant effect on the characteristic of the number of branches of the wheat plant if it reached its highest value. When spraying treatment (F2) reached (10.66) branches, compared with two treatments F0 and F1, which had a value of (5.8) branches and increase rates of (113.2, 33.25%) for each successively. It was also noted that the addition of different levels of humic acid had a significant effect on Increasing the characteristic of the number of branches of the wheat plant and that the highest value of it was at the parameter H2, which amounted to 9 branches, compared to the two coefficients H0 and H1, which amounted to 6.6,8) branching and due to an increase of (36.36,12.5%) for each of them respectively, as for the effect of the interaction between spraying With iron component and ground addition of different levels of humic acid, it had a significant effect on this characteristic (the characteristic of the number of branches and that the highest value) for this characteristic was when the intervention treatment (F2H2) whose value reached (12) branching and the lowest value for the characteristic of the number of branches was when the comparison treatment (F0H0) Without adding the ground The spray rate with iron element, whose value was (4) branched, and the interference treatment (F2H1) gave the number of branches reached 11 () branching and did not differ significantly from the treatment of double interference (F2H2). As for the percentage increase of the interference treatment (F2H2) over the comparison coefficient (F0H0) Its percentage reached (20%), as shown in Table (5)

Table 5 : The effect of spraying with iron, ground addition of humic acid and the overlap between them on the number of branches of wheat plant (cm)

branches (cm)	F0	F1	F2	average
H0	4	7	9	6.6
H1	5	8	11	8
H2	6	9	12	9
average	5	8	10.66	
L.S.D(0.05)	**F**	**H**	**F*H**	
	0.21	0.21	0.44	

Chlorophyll guide (Spad unit)

The results of the statistical analysis indicated in Table (6) that the effect of spraying with iron element and ground addition of different levels of humic acid had a significant effect on the characteristic of the chlorophyll index (Spad unit), as it is noticed from the table that the effect of spraying with the element of iron had a significant effect in increasing the characteristic of the index of chlorophyll (Spad unit) for the wheat crop and that its highest value was at the transaction (F2) in which it was (Spad unit 57.54) compared to the two treatments (F0, F1) whose value was (Spad unit 49.57) with an increase of (16.07,11.57%) It is also noticed from the table that the effect of the levels of ground addition of humic acid had a significant effect on the characteristic of the chlorophyll spad unit of the wheat plant and that its highest value was at the treatment (H2) whose value was (54.52) (Spad unit) measured With the two treatments (H0, H1) whose value amounted to (50.47,53.68) (Spad unit) and rates of increase of (8.05.1.5%) for each of them sequentially as for the effect of the interference between spraying with the iron element and the addition of ground levels of humic acid, it was therefore when the two-interference treatment (F2H2), whose value was (57.85 Spad unit), or the lowest value was for evidence The chlorophyll (Spad unit) was when the comparison treatment was (F0H0) whose value was (17.33) (Spad unit), with an increase of 25.0%

Table 6 : The effect of iron spraying, ground addition of humic acid and the overlap between them in the chlorophyll guide (Spad unit).

Chlorophyll (spad unit)	F0	F1	F2	average
H0	47.33	48.50	55.60	50.47
H1	50.39	52.80	57.85	53.68
H2	51.00	53.41	59.17	54.52
average	49.57	51.57	57.54	
L.S.D(0.05)	**F**	**H**	**F*H**	
	0.61	0.61	3.13	

It is noted from Table (3, 4, 5, 6) that spraying with iron component and ground addition of different levels of humic acid had a significant effect on the characteristics of urban growth and wheat crop. If spraying with iron had a significant effect on the effects of the study mentioned all together, it may change the reason for This is because of the role of iron in the growth and development of the plant due to its entry into the non-self structure inside the plant, if between (Kirkiby and Mengel, 2001) that iron has two basic benefits in the vital processes of plants. The first is that it activates the oxidation and reduction enzymes in the electron transmission chain in the respiration process and the second that it helps build chlorophyll as it is. It has a role in increasing the growth, development and division of cells, which is reflected in the height of the plant and its visit to the number of branches as it shares vital compounds before (cytochromes) that enter the process of photosynthesis, respiration and active absorption between (Hassan *et al*., 1990) that iron has many important functions in plants and this is for sure. The intensity of the vegetative growth is reflected, which leads to an increase in plant height, leaf area and the number of branches of the wheat crop. The iron component is after the combined strength of many vital activities carried out by the plant and the hand Iron vinegar in the formation of (ferrodoxin), which is an iron protein found in green plastids and participates in the photosynthesis process through its contribution to oxidation and reduction processes. How many electrons in all these processes will affect the increase of all indicators of the above study of growth traits (Ali *et al*., 2014) These results Agreed with (Al-Badiri, 2001) and (Al-Wasi *et al.*, 2002) who indicated that spraying with iron element and different concentrations increased all the characteristics of vegetative growth and various crops. As for the ground additive effect of humic acid, it had a significant effect in increasing all the indicators of vegetative growth of the nutrient crop for absorption, especially Major and minor by the fact that this acid works to capture the pH in the root zone and then increase the presence of these nutrients, which led to the liberation of these nutrients from the soil and then increase their concentration, and this in turn leads to an increase in the building of amino acids, which are the first nucleus of growth and the consequences of This is from a significant increase in plant height and its reflection on the leaf area, then the increase in the number of branches and the chlorophyll index of the wheat plant (Ahmed *et al*., 2009), which may be considered the reason for the y To you that the offspring of humic acid produces nitrogenous and phosphate compounds and other organic compounds that have a role in increasing the growth, development and division of cells and increasing the growth of roots, which enables the indicators of vegetative growth represented by increasing plant height, leaf area, number of branches and chlorophyll index for wheat (Havlin *et al*., 2005) As for the interaction effect between spraying with the iron element and the ground addition of different levels of humic acid, which led to an increase in the main nutrients, especially the micro-nutrients represented by spraying with the iron element by the plant, which led to the development of vegetative growth and increased activity of meristemat, and then increased plant height, chlorophyll index and leaf area, which provided an opportunity for the plant. The investment of these nutrients leads to an increase in the rates of photosynthesis, which also reflects an increase in the chlorophyll index (Al-Qaisi, 2010).

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