The Relationship Between Hydrogen Peroxide, Zinc, and Humic Fulvic Acid in some of Elemental Content in Barley Plant (*Hordeum vulgare* L.)

Wifak Amjad AL-kaisy **Raed Mohammed Sarhan AL-Janabi**
Department of Biology
College of Education for pure Sciences/ Ibn AL-Haitham, Baghdad University

Abstract

The experiment was carried out with the aim of identifying the harmful effect of hydrogen peroxide (0,2,4)% and treating it with three increasing concentrations of humic fulvic acid (0,25,50) $mg.L^{-1}$ and four concentrations of zinc (0,50,100,150) $mg.L^{-1}$ in some of the major elements (nitrogen, phosphorus, potassium) and micro (zinc and iron) Randomized Complete Block Design with three replicates and 108 experimental units showed the following results:

1. Hydrogen peroxide concentrations 4% have a negative effect on the values of the studied traits
2. The effect of both the humic fulvic acid and the zinc element had a positive effect on the content of the elements
3 - The role of the high concentrations of each of them to give an increase rates for all those qualities
4. The triple interference between hydrogen peroxide concentrations 4% and spray with high concentration of acid and element was positive in reducing the impact of chemical stress. .

Keywords: barley plant, zinc, humic fulvic acid, hydrogen peroxide.

Introduction

hydrogen peroxide A compound containing two oxygen atoms with a single polymer that is distinctly water-like in its outer form but more viscous produces hydrogen peroxide in the cells at stress than a superoxide reaction with two hydrogen atoms to produce the hydrogen peroxide molecule [1,2]. The hydrogen peroxide molecule is highly effective and active. It is one of the root compounds with a multiplier effect of free radicals that destroys cells and tissues and is important in the process of self-suicide. It also has the ability to move inward and through cell membranes, and here is its danger [3].

Barley ***(Hordeum vulgare* L.)** is the fourth largest crop in the world and comes in terms of economic importance after wheat, rice and maize, each covering around 30% of the total grain in the world [4]. In Iraq, barley is one of the major crops in Iraq and comes second in importance after the wheat crop 36% Of the total area cultivated with grain crops, which enters a high percentage in the composition of animal feed and some local industries as well as it forms part of human food [5].

Zinc is an important nutrient for plants that is absorbed in the form of divalent cations and has various physiological roles in higher plants and is involved in the metabolism of proteins, carbohydrates, nucleic acids and lipids, photosynthesis and biosynthesis of auxin [6].

Research is taken from Ph.D the thesis for the first researcher

Similarly zinc is also an important micro nutrient element which increases resistance to disease in plant. the Zn application improved the efficiency of applied phosphorus as higher grain yield in chickpea. Zinc is involved in the channelization of photosynthesis during reproductive stage by way of its involvement in electron transfer [7,8]. This element is used as part of the structure of enzymes or acts as regulator cofactors in a number of enzymes. Research has shown that Zn is used in the building of at least four enzymes: carbonic anhydrase, Cu-Zn superoxide dismutase, alcohol dehydrogenase, RNA polymerase. Other enzymes have been discovered that need Zn for activity, the most important of these enzymes include alcohol dehydrogenase, aldolase, trans-phosphorylase, DNA and RNA polymerase [9].

Humic substances: The main constituents of HSs are aromatic and aliphatic structures, carboxylic, phenolic-OH, amino and quinone groups. HSs can be divided into three main fractions: humin which is completely insoluble, humic acid which is soluble at high pH but insoluble under acid conditions and fulvic acid which is soluble at any pH [10]. Humic acid is one of these naturally produced organic acids, which is a humic substance derived from the decomposition of organic matter. Its addition to soil increases the plant's absorption of nutrients as it acts as a medium to transfer nutrients from soil to plants, especially in the case of drought [11]. Due to the lack of studies of these factors and the increase in the problem of chemical stress, the aim of the experiment is to know the effect of humic fulvic acid and zinc element in improving the growth characteristics of barley plant under the influence of chemical stress.

Materials and Methods

Site and design experience

The experiment was conducted in the field of the Department of Biology within the College of Education for Pure Sciences - Ibn Al Haytham / University of Baghdad the Winter Growth Season 2018-2017. The experiment was designed according to the Randomized Complete Block Design (RCBD) as a Worker experience and three replicates (3 × 3 × 4 × 3), the cultivation of barley seeds was done on 01/12/2017.

The experiment included the following factors:

1. Hydrogen Peroxide Concentrations (0,2,4)%
2 - Concentrations humic fulvic acid (0,25,50) mg.L^{-1}.
3. Zinc sulphate concentrations (0,50,100,150) mg.L^{-1}.

The plants were sprayed with hydrogen peroxide at 52 days and sprayed with humic fulvic acid, and zinc at the age of 54 and 55 days. The samples were taken from the plant tissue 78 days old, then dried in an electric oven and digested by [12].

The following characteristics were studied:

1. Determination of total nitrogen content (Milligrams. plant-^{1}) as [13].
2. Determination of total phosphorus content (Milligrams. plant-^{1}) According to [14].
3. Determination of total potassium content (Milligrams. plant-^{1}) according to the method used by [13].
4. Determination of iron, zinc (Microgram. Plant-^{1}) according to [15].

The statistical program SAS [16] was used to compare the significant differences between the least significant differences (0.05).

Results and Discussion

The results of the table (1,2,3,4,5) on the sequence showed the negative effect when increasing the concentration of hydrogen peroxide from 0 to 4% in all studied traits. The mean values of nitrogen, phosphorus, potassium, zinc, iron decreased by 44.35, 49.25, 47.39, 42.65, and 30.71%, respectively, for the above mentioned qualities.

The results of the table showed significant differences in the spraying of humic vulvic acid in the increase of the mean of the studied traits and the concentration of 50 mg.L^{-1} in achieving the highest mean of the studied traits compared to the control treatment with 63.42, 67.23, 59.16, 15.77 and 14.58% The content of nitrogen, phosphorus, potassium, zinc, iron, respectively.

The results of the zinc spraying were similar to the results of the acid spraying in the increase of the mean of the studied traits. When the concentration was increased from 0 to 150 mg.L^{-1}, the ratios of the studied traits increased significantly 66.17, 67.76, 61.98, 30.00 and 13.32% for each of the nitrogen, phosphorus, potassium , Zinc, iron respectively.

In addition, the results of the double interference between the concentrations of hydrogen peroxide and humic vulvic acid showed significant differences in acid in reducing the effect of chemical stress when spraying with the humic vulvic acid of 50 mg.L^{-1} Under the influence of 4% hydrogen peroxide, the mean properties of both nitrogen, Phosphorus, potassium, iron respectively, 78.37, 74.42, 66.15 and 15.03%, while the zinc content had no significant effect.

The effect of the binary overlap between the concentration of hydrogen peroxide and the zinc element was also significant when lifting the concentration to 150 mg.L^{-1} zinc and under the influence of the concentration of hydrogen peroxide 4% All the average of the characteristics significantly compared to the lack of spray of acid as the increase rate 72.51, 72.40, 67.55, 34.22, 11.68% for both nitrogen, phosphorus, potassium, zinc and iron content respectively.

The results of the two-way interaction showed the significant effect of the interaction between the acid and the element. When spraying with concentrations 50 and 150 mg.L^{-1}, the average values of nitrogen, phosphorus, potassium and iron content increased respectively, while zinc content had no significant effect.

The results confirmed the positive role of the interaction between the spraying of acid and zinc under the concentrations of hydrogen peroxide at the concentration of 2% of hydrogen peroxide and spray with acid and zinc concentrations 50 and 150 mg.L^{-1} to increase values of nitrogen content, phosphorus, potassium, iron, which amounted to 178.95, 190.35, 170.65 and 28.00%, respectively, while the zinc content did not have any significant effect, which proved that all the workers employed in the experiment had a positive effect in reducing the effect of chemical stress, and the results showed that the concentration of hydrogen peroxide 4% led to a decrease in the studied qualities.

The increased concentration of hydrogen peroxide reduced the content of elements N, P, K, Zn, Fe. The reason for the decrease is due to the accumulation of free radicals, which inhibits the enzymes of nitrate reductase and nitrogenase. It also affects the activity of nitrogen fixing bacteria [17] The results were agreed with [18] on the barley plant.

The increased concentration of zinc concentrations has increased the content of N, P, K, Zn and Fe elements due to the growth process that requires energy to build the protein necessary for the biological metabolism. Is necessary for the process of phosphorylation and glucose formation and is involved in the construction of enzymes responsible for the representation of carbohydrates are destroyed and burned and converted to ATP in the process of breathing so zinc is necessary for the process of phosphorylation and is important in the representation of phosphatidic fats Such as lysine, which is important in the transfer of electron through cellular membranes with the presence of ATP, thus increasing the energy compounds necessary for bio-absorption and thus increasing the ability of plant roots to absorb nutrients that need absorption into energy [19]. Zinc plays an important role in maintaining the stability of the plasma membrane It binds to the SH-sections of the protein portion of the membrane and thus protects it from oxidation, thereby increasing its complementarity and increasing its ability to withdraw important nutrients [20] the results were agreed with [21] on chickpeas.

This increase is due to the role of humic fulvic acid as a rich source of nitrogen as well as to the presence of important amino acids that increase the permeability of cellular membranes that are installed in the form of [22]. These amino acids act to modify the phospholipids of the cellular membranes, making the cell membrane better in the passage of extracellular nutrients to the cell cytoplasm, thus improving plant nutrition and nutrient uptake [23], As well as the indirect effect of acid on the characteristics of vegetative growth and vitality and increase absorption by the root and leaves and increase the efficiency of photosynthesis and the paper content of chlorophyll and increased vegetative growth requires the absorption of larger amounts of elements [24]. The increase in phosphorus and potassium absorbed in the vegetative segment is a sign of high plant responsiveness by utilizing added humic acid as phosphorus uptake is increased at the early stages of plant growth [25,26] the results were consistent with [27] on maize plant.

Table (1) Effect of concentration of humic fulvic acid and zinc in nitrogen content (Milligrams. plant-^{1}) of barley plant exposed to hydrogen peroxide stress.

A (%)	H and F (mg.L^{-1})	Concentrations of Z (mg.L^{-1})				Average of A× H and F
		0	50	100	150	
0	0	101.69	131.94	144.33	165.62	135.90
	25	136.13	150.78	175.65	214.81	169.34
	50	165.98	193.84	227.06	283.26	217.54
2	0	68.86	96.47	115.70	131.66	103.17

	25	99.78	121.43	142.18	164.57	131.99
	50	128.98	152.23	177.55	192.09	162.71
4	**0**	42.10	61.65	76.05	99.58	69.84
	25	70.24	87.68	105.99	122.06	96.49
	50	101.8	117.07	131.66	147.79	124.58
Average of Z		101.73	123.68	144.02	169.05	**1.68**
L.S.D (0.05)		**Effect of Z**			**1.12**	
		Effect of triple interference			**3.37**	

Effect of A ×Z

A (%)	**Concentrations of Z (mg.L^{-1})**				**Average of A**
	0	**50**	**100**	**150**	
0	134.6	158.85	182.35	221.23	174.26
2	99.21	123.38	145.14	162.77	132.63
4	71.38	88.80	104.57	123.14	96.97
L.S.D (0.05)	**1.95**				**0.97**

Effect of H and F×Z

H and F (mg.L^{-1})	**Concentrations of Z (mg.L^{-1})**				**Average of H andF**
	0	**50**	**100**	**150**	
0	70.88	96.69	112.03	132.29	102.97
25	102.05	119.96	141.27	167.15	132.61
50	132.25	154.38	178.76	207.71	168.28
L.S.D (0.05)	**1.95**				**0.97**

A = hydrogen peroxide ** H and F= humic fulvic acid ** Z= zinc

Table (2) Effect of concentration of humic fulvic acid and zinc in the content of phosphorus (Milligrams. plant-^{1}) of barley plant exposed to hydrogen peroxide stress.

A (%)	**H and F (mg.L^{-1})**	**Concentrations of Z (mg.L^{-1})**				**Average of A× H and F**
		0	**50**	**100**	**150**	
0	**0**	30.34	39.34	42.19	48.55	40.10
	25	40.62	45.26	51.9	64.51	50.57
	50	48.2	58.01	68.15	84.46	64.71
2	**0**	19.28	27.16	32.39	36.37	28.80
	25	28.23	34.32	40.17	47.52	37.56
	50	36.04	53.52	51.17	55.98	49.18

4	**0**	11.13	17.13	21.52	26.86	19.16
	25	19.73	23.7	28.73	32.89	26.26
	50	26.87	32.00	35.04	39.77	33.42
Average of Z		28.94	36.72	41.25	48.55	**2.43**
L.S.D (0.05)		**Effect of Z**		**1.62**		
		Effect of triple interference		**4.87**		

Effect of A ×Z

A (%)	**Concentrations of Z (mg.L^{-1})**				**Average of A**
	0	**50**	**100**	**150**	
0	39.72	47.53	54.08	65.84	51.79
2	27.85	38.33	41.24	46.63	38.51
4	19.24	24.28	28.43	33.17	26.28
L.S.D (0.05)	**2.81**				**1.40**

Effect of H and F×Z

H and F (mg.L^{-1})	**Concentrations of Z (mg.L^{-1})**				**Average of H andF**
	0	**50**	**100**	**150**	
0	20.25	27.88	32.03	37.26	29.36
25	29.53	34.42	40.27	48.31	38.13
50	37.04	47.84	51.45	60.07	49.10
L.S.D (0.05)	**2.81**				**1.40**

A = hydrogen peroxide ** H and F= humic fulvic acid ** Z= zinc

Table (3) Effect of concentration of humic fulvic acid and zinc in the content of potassium (Milligrams. plant-^{1}) of barley plant exposed to hydrogen peroxide stress.

A (%)	**H and F (mg.L^{-1})**	**Concentrations of Z (mg.L^{-1})**				**Average of A× H and F**
		0	**50**	**100**	**150**	
0	**0**	115.03	143.68	158.29	183.44	150.11
	25	149.11	169.31	197.15	239.28	188.71
	50	188.03	220.30	254.48	299.36	240.54
2	**0**	75.47	106.72	127.65	141.32	112.79
	25	109.30	132.17	152.67	175.69	142.46
	50	138.53	160.00	187.59	204.26	172.59
4	**0**	48.06	67.15	83.35	106.05	76.15
	25	76.91	93.19	110.30	128.07	102.12

	50	104.31	119.74	132.02	150.06	126.53
Average of Z		111.64	134.70	155.94	180.84	**0.976**
L.S.D (0.05)		**Effect of Z**		**0.651**		
		Effect of triple interference		**1.952**		

Effect of A ×Z

A (%)	**Concentrations of Z (mg.L^{-1})**				**Average of A**
	0	**50**	**100**	**150**	
0	150.73	177.76	203.31	240.69	193.12
2	107.77	132.96	155.97	173.76	142.61
4	76.43	93.36	108.56	128.06	101.60
L.S.D (0.05)	**1.127**				**0.563**

Effect of H and F×Z

H and F (mg.L^{-1})	**Concentrations of Z (mg.L^{-1})**				**Average of H andF**
	0	**50**	**100**	**150**	
0	79.52	105.85	123.10	143.60	113.02
25	111.77	131.56	153.37	181.02	144.43
50	143.63	166.68	191.36	217.89	179.89
L.S.D (0.05)	**1.127**				**0.563**

A = hydrogen peroxide ** H and F= humic fulvic acid ** Z= zinc

Table (4) Effect of concentration of humic fulvic acid and zinc in the content of zinc (Microgram. Plant-[1]) of barley plant exposed to hydrogen peroxide stress.

A (%)	**H and F (mg.L^{-1})**	**Concentrations of Z (mg.L^{-1})**				**Average of A× H and F**
		0	**50**	**100**	**150**	
0	**0**	157.33	173.33	183.67	195.67	177.50
	25	169.33	184.33	198.67	214.00	191.58
	50	177.67	196.33	207.67	219.00	200.17
2	**0**	107.33	124.67	133.67	147.00	128.17
	25	119.33	135.00	147.67	156.00	139.50
	50	123.67	135.00	158.33	167.67	146.17
4	**0**	80.33	92.67	102.33	112.33	96.92
	25	95.00	103.00	117.33	123.67	109.75
	50	101.33	116.00	126.33	135.33	119.75
Average of Z		125.70	140.04	152.85	163.41	**N.S.**
L.S.D (0.05)		**Effect of Z**		**1.87**		

	Effect of triple interference N.S				
Effect of A ×Z					
A (%)	**Concentrations of Z (mg.L^{-1})**				**Average of A**
	0	**50**	**100**	**150**	
0	168.11	184.67	196.67	209.56	189.75
2	116.78	131.56	146.56	156.89	137.94
4	92.22	103.89	115.33	123.78	108.81
L.S.D (0.05)	**3.24**				**1.62**
Effect of H and F×Z					
H and F (mg.L^{-1})	**Concentrations of Z (mg.L^{-1})**				**Average of H andF**
	0	**50**	**100**	**150**	
0	115.00	130.22	139.89	139.89	151.67
25	127.89	140.78	154.56	154.56	164.56
50	134.22	149.11	164.11	164.11	174.00
L.S.D (0.05)	**N.S.**				**1.62**

A = hydrogen peroxide ** H and F= humic fulvic acid ** Z= zinc

Table (5) Effect of concentration of humic fulvic acid and zinc in the iron content (Microgram. Plant-[1]) of barley plant exposed to hydrogen peroxide stress.

A (%)	**H and F (mg.L^{-1})**	**Concentrations of Z (mg.L^{-1})**				**Average of A× H and F**
		0	**50**	**100**	**150**	
0	**0**	598.33	648.33	681.67	710.00	659.58
	25	670.00	710.00	741.67	753.33	718.75
	50	715.00	750.00	775.00	820.00	765.00
2	**0**	500.00	538.33	558.33	585.00	454.42
	25	550.00	580.00	595.00	615.00	585.00
	50	585.00	600.00	630.00	640.00	613.75
4	**0**	430.00	460.00	465.00	485.00	460.00
	25	468.33	488.33	500.00	526.67	495.83
	50	500.00	525.00	541.67	550.00	529.17
Average of Z		557.41	588.89	609.81	631.67	**6.02**
L.S.D (0.05)		**Effect of Z 4.02**				
		Effect of triple interference 12.04				
Effect of A ×Z						
A (%)		**Concentrations of Z (mg.L^{-1})**				**Average**

	0	50	100	150	of A
0	661.11	702.78	732.78	761.11	714.44
2	545.00	572.78	594.44	613.33	581.39
4	466.11	491.11	502.22	520.56	495.00
L.S.D (0.05)	**6.95**				**3.48**

Effect of H and F×Z					
H and F (mg.L^{-1})	**Concentrations of Z (mg.L^{1})**				**Average of H andF**
	0	**50**	**100**	**150**	
0	509.44	548.89	568.33	593.33	555.00
25	562.78	592.78	612.22	631.67	599.86
50	600.00	625.00	648.89	670.00	635.97
L.S.D (0.05)	**6.95**				**3.48**

A = hydrogen peroxide ** H and F= humic fulvic acid ** Z= zinc

Reference

1- Held, P. (2015). An introduction to reactive oxygen speciesmeasurement of ROS in cells.Applications Dept., BioTek Instruments, Inc.1-21.

2- Majeed, M.A.; Sardar ,A. and Malik, S.R.(2014). Extraction of Byproducts of Hydrogen Peroxide Working Solution Using Solvent. Biological and Chem. Res. 14: 34-39.

3- Zhou, P.; Zhang, J., Zhang, Y., Liu, Y., Liang, J., Liu, B. and Zhang, W. (2016). Generation of hydrogen peroxide and hydroxyl radical resulting from oxygen-dependent oxidation of L-ascorbic acid via copper redox-catalyzed reactions . Royal Society of Chem. , 6(45): 38541 – 38547.

4- FAO. (2004). Statistics of Food and Agriculture Organization.Rome,Italy.

5- Grando, S.(2002). Food barley grains- overdue. Attention-ICARDA. Caravan 16.

6- Malakoti, M.J. and Tehrani, M.M. (2001) Effects of Micronutrients on the Yield and Quality of Agricultural Products. Micro-Nutrients with Macro-Nutrients. 2nd Edition, Tarbiat Modarres University Press, Tehran.

7- Baker, N. R., Fernyhough, P., & Meek, I. T. (1982). Light-dependent inhibition of photosynthetic electron transport by zinc. *Physiologia Plantarum*, *56*(2), 217-222.

8- Balai, K., Sharma, Y., Jajoria, M., Deewan, P., & Verma, R. (2017). Effect of Phosphorus, and Zinc on Growth, Yield and Economics of Chickpea (Cicer aritinum L.). *Int. J. Curr. Microbiol. App. Sci*, 6(3), 1174-1181.

9- Mohsenzadeh, S., & Moosavian, S. S. (2017). Zinc Sulphate and Nano-Zinc Oxide Effects on Some Physiological Parameters of Rosmarinus officinalis. *American Journal of Plant Sciences*, 8(11), 2635.

10- Sakarinen, E. (2016). Humic acid removal by chemical coagulation, electrocoagulation and ultrafiltration. Thesis

11- Arslan G, E. Pehlivan. (2008). uptake of Cr^{3+} from Aqueous Solution by lignite-based humic acids. Bioresour Technol. 99:7597–7605.

12- Agiza, A.H.; El-Hineidy, M.T. and Ibrahim, M.E. (1960). The determination of the different fractions of phosphorus in plant and soil. Bull. FAO. Agric. Cairo Univ.: 121 P.
13- Chapman, H. D. and Pratt, P. F. (1961). Methods of analysis for Soils, Plant, and Water. Univ. Calif. Div. Agric. Sci., USA.: 33 - 35.
14- Matt, K. J. (1970). Colorimetric determination of phosphorus in soil and plant materials with ascorbic acid. Soil Sci., 109:214-220.
15- Allan , J.E. (1961). The determination of zinc in agricultural material by atomic absorption spectrophotometer . Analyst , Lond., 530 – 534.
16- SAS. (2012). Statistical Analysis System, users Guide. Statiscal. Version 9. 1th ed. SAS. Inst. Inc.Cary. N.C. USA.
17- Aroca, R. (2012). Plant Responses to Drought Stress From Morphological to Molecular Features. Springer , Heidelberg , Berlin . 466P.
18- Arkwazi, Aso Latif Aziz (2016). Effect of paper spraying on hydrogen peroxide and vitamin C in the growth and yield of two varieties of barley plant (Hordeum vulgare L.) cultivated in the demography area. College of Education for Pure Sciences - Ibn al - Haytham. University of Baghdad.
19- Verma , s.k. and Verma , M. (2010). A Textbook of Plant Physiology ,Bichemistry and Bioteclrnology . 10* ed . s. Chatrd and Company, LTD., Ram Nagar- , New Delhi , India.
20- Slrarma , P.N. ; Kumar , N. and Bisht, s.s. (1994) .Effect of zinc deficiency onchlorophyll content, photosynthesis and water relations of cauliflower plants. Photosynthetica, 30:353- 359.
21- Al-Qazzaz, Amal Ghanem Mahmoud (2014). The role of paper feed in zinc and boron in some growth indicators of chickpeas Cicer arietinum L. Ibn al-Haytham Journal of Pure and Applied Sciences (27) (2): 13-23.
22- Pettit, R.E.(2004). Organic Matter, Humus, Humate, Humic Acid, Fulvic Acid and Humin; Their Importance in Soil Fertility and Plant Health [Online]. Available at www.humates .com.
23- Al-Sahaf, F. H. (1989). Plant Nutrition Application . Ministry of Higher Education and Scientific Research. Book House Press. University of Musul. Iraq. pp 198.
24- Verlinden , G ; B,Pycke ; J. Mertens ; F. Debersagues ; K. Verheycn ; G. Baert ; J. Bries and G. Haesaert .(2009). Application of humic substances results in consistent increases in crop yield and nutrient uptake .J. plant Nut. 32(9): 1407-1426.
25- Zahedifar, M.; N. Karimian; A. Ronaghil; Y. Yasrebi; Eman and A.A. Mossavi. (2011). Effect of phosphorus and organic matter on phosphorus status of winter wheat at different part and growth stages. J. of Plant Breeding and Crop Sci. 3 (15) : 401-412.
26- Denre, M., S., Ghanti, and K. Sarkar,. (2014). Effect of humic acid application on accumulation of mineral nutrition and pungency in garlic (Allium sativum L.). International Journal of Biotechnology and Molecular Biology Research, 5(2): 7-12.
27- Al-Ani, Ahmed Salman Hamad (2018). Effect of Humic Acid and Bacterial and Nitrogen Bacterial Fertilizers on the Preparedness of Some Nutrients and the Growth and Producing of Yellow Maize (Zea mays L.) Ph.D. Thesis College of Agriculture, University of Baghdad.

العلاقة بين بيروكسيد الهيدروجين والزنك وحامض الهيومك فولفيك في محتوى بعض العناصر في نبات الشعير (*Hordeum vulgare* L.)

وفاق أمجد القيسي ، رائد محمد سرحان الجنابي

جامعة بغداد / كلية التربية للعلوم الصرفة / ابن الهيثم – قسم علوم الحياة

الملخص:

اجريت التجربة بهدف لمعرفة الأثـر الضـار لبيروكسـيد الهيـدروجين (4,2,0)% ومعالجته بثلاثة تراكيز متزايدة من حامض الهيومك فولفيك (50,25,0) ملغم. لتـر$^{-1}$ وأربعـة تراكيز من عنصر الزنك (150,100,50,0) ملغم. لتر$^{-1}$ في بعض محتوى العناصـر الكبـرى (النتروجين ، الفسفور ، البوتاسيوم) والصغرى (الزنك والحديـد) لنبـات الشـعير وصـممت التجربة وفق نظام القطاعات العشوائية الكاملة وبثلاث مكررات و 108 وحده تجريبية أظهـرت النتائج ما يلي :

1- أثرت تراكيز بيروكسيد الهيدروجين4% تأثير سلبيا في قيم المتوسطات الصفات المدروسة
2- كان تأثير كل من حامض الهيومك فولفيك وعنصر الزنك تأثير إيجابيا في محتوى العناصر
3- كان الدور التراكيز العالية لكل منهما في إعطاء نسب زيادة لجميع تلك الصفات
4- كان التداخل الثلاثي بين تراكيز بيروكسيد الهيدروجين 4% والرش بـالتركيز العاليـة مـن الحامض والعنصر إيجابيا في التقليل من أثر الإجهاد الكيميائي. .

الكلمات المفتاحية : نبات الشعير ، حامض الهيومك فولفيك , الزنك، بيروكسيد الهيدروجين.