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EFFECT OF APPLYING SELENIUM ELEMENT AND ASCORBIC ACID ON REDUCING THE HARMFUL EFFECT OF ENVIRONMENTAL STRESS ON WHEAT PLANTS IRRIGATED BY WATER CONTAMINATED WITH LEAD AND CADMIUM

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Abstract

A field experiment was conducted in a field of College of Agricultural Engineering Sciences, University of Baghdad, Jadrya during the winter season 2016 to investigate the combined effect of adding selenium and ascorbic acid on reducing the effect of the environmental stress on wheat plant, irrigated by water contaminated with selenium and cadmium elements. The soil of experiment was silty loam classified among the Typic Torrifluvent group. Randomized Complete Block Design of three replicates with spilt-split plot order was used where the main plots were devoted to the contaminated water symbolized by W1, W2, W3 and W4, while the subplots were devoted to concentrations of ascorbic acid (0, 50 and 100 mg.l^{-1}) symbolized by AS and the sub-sub plots were devoted to the different concentrations of selenium element (0, 10 and 20 mg.l^{-1}) symbolized by Se. Results showed the superiority of the third concentration of selenium element giving the highest available lead concentration in the soil after harvest 2481.18 mg.kg^{-1}, as well as the superiority of the third concentration of ascorbic acid that increased the concentration of lead in the soil to reach 2697.51 mg.kg^{-1}. The concentrations of lead and cadmium in the soil after harvest were increased as a result of lead and cadmium increment in the contaminated water. The tri interaction had a significant effect on the available lead increasing to 4894 mg.kg^{-1} in the soil after harvest. Adding selenium also decreased the lead concentration in the hay and grains significantly to reach 75.32 and 21.87 mg.kg^{-1} dry matter for selenium respectively. The third concentrations of both selenium and ascorbic acid were significantly superior in increasing cadmium concentration in the soil after harvest 40.80 and 44.57 mg.kg^{-1} respectively. Results also illustrated significant decline in the cadmium concentration reached to 1.63 and 2.06 mg.kg^{-1} dry matter resulted from adding the third concentration of selenium and ascorbic acid respectively. The tri interaction had a significant effect decreased the cadmium concentration in grains.

Key words: selenium element, ascorbic acid, environmental stress, cadmium.

Introduction

Water in most parts of the world is an important economic resource, so evaluating water quality is a major and important issue in agriculture. Water quality used for irrigation plays an important role in affecting soil properties and then crop growth and productivity in quantity and quantity (Mireles *et al.*, 2012). The main cause of water contamination is draining water with unprocessed wastes or processed insufficiently in the rivers. Among the contaminants are the heavy elements that have the potential to accumulate in living organisms to the point of poisoning of the final consumer (Korboule *et al.*, 2007). Heavy elements are those elements whose specific weight greater than 5 g / cm 3 (Suciu *et al.*, 2008) and have a poisonous effect including changing in the processes of photosynthesis and respiration, inhibiting plant growth, affecting mineral nutrition and gas exchanging and influencing on water relationships, as well as they negatively affecting the membranes, reproduction and plant content of chlorophyll, carotenes and proteins (Shi and Cai, 2008; Heidari and Sarani, 2011; Sharma *et al.*, 2012). Ascorbic acid (Vitamin C) is a non-enzymatic antioxidant utilized by plant under stress conditions to deal with the negative effect of reactive oxygen species

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Table 1: Some physical and chemical properties of the soil under studying.

pH	EC dS.m^{-1}	Avaialbe Aions mg kg^{-1} soil					Total mg kg^{-1} soil		Soil textue	Soluble cations and anions m mole L^{-1}					
		N	P	K	Cd	Pb	Cd	Pb		Ca^{++}	Mg^{++}	Na^{+}	$SO_4^{=}$	Cl^{-}	HCO_3^{-}
7.11	2.8	35	7.2	115	0.03	0.56	0.08	24.3	SL	23.4	19.81	6.82	2.64	24.1	0.93

(Mittler, 2006), in addition to its role as a coenzyme, an anti-poisoning and a regulator for plant harmonic signals during interval between the vegetative stage and the reproductive stage (Barth *et al.*, 2006; Ahmad *et al.*, 2014). It has several roles in plant growth such as cell division and cell wall extension as well as other development processes (Pignocchi and Foyer, 2003). Selenium is also considered one of the most important anti-oxidants. It acts as a catalyst in the metabolism of enzymatic and non-enzymatic antioxidants (Alazzawi and Faisal, 2015). One of its important effect that it participates with the metabolism of the secondary product in the medicinal plants and it unites with amino acids to produce metal proteins of super-tolerance to environmental stress; furthermore, it contributes to the formation of the two amino acids, Selenomethionine and Selenocysteine which are considered the newest antioxidants (Turanov *et al.*, 2011). Given the limited freshwater and arable water and the growing demand for food as a result of the increasing population of the world, farmers tended to irrigate with water of lower quality and in some cases contaminated with some heavy elements. The aim of the study is to study the combined effect of the element of selenium and ascorbic acid in reducing the environmental stress on wheat plant irrigated with water contaminated by lead and cadmium.

Materials and Methods

A field experiment was conducted at the fields of College of Agricultural Engineering Sciences, University of Baghdad, Jadirya during the winter season 2016. The experiment soil was silty loam classified within the Typic Torrifluvent according to the world classification Soil survey staff (2006). Samples were taken randomly from the surface layer of the soil in depth 0-30 cm. The soil samples were dried by air, crushed and passed through 2 mm diameter sieve. They were mixed and a represented sample was taken for soil chemical and physical analysis to recognize the soil characteristics listed in table 1. Randomized Complete Block Design (RCBD) of three replications within split-split plots order was used. The main plots were devoted to the treatments of the contaminated water symbolized by W1 (normal water), W2 (contaminated by 10 mg.L^{-1} lead + 2ml.L^{-1} Cadmium), W3 (contaminated by 20 mg.L^{-1} lead + 4ml.L^{-1} Cadmium) and W4 (contaminated by 30mg.L^{-1} lead + 6ml.L^{-1} Cadmium), while the subplots were devoted to the treatments of spraying different concentrations of ascorbic acid (0, 50 and 100 mg.l^{-1}) symbolized by AS and the sub–sub plots contained the treatments of spraying different concentrations of Selenium (0, 10 and 20 mg.l^{-1}) symbolized by Se. Wheat seeds were sowed in 1.5 × 1.5 m plots and plants were fertilized, by 200kg N.ha^{-1}, 100kg P.ha^{-1} and 120kgK.ha^{-1} using the fertilizers Urea (46% N), tri superphosphate (21% P) and potassium sulfate (41% K) respectively. Selenium and ascorbic acid were applied during three growth stages (tillering, booting and flowering); the weeding was done manually and the crop was irrigated whenever needed.

Results and Discussion

Available lead concentration in soil after harvesting (mg.kg^{-1})

Results in table 2 illustrate the significant differences among the treatments of selenium concentrations. The highest concentration of lead 2481.18 mg.kg^{-1} was obtained from the third concentration of selenium with

Table 2: Available lead concentration in soil after harvest (mg.kg^{-1}).

AS*Se	W4	W3	W2	W1	Se	AS
1997.3	3796	2628	1565	0.31	Se 1	AS1
2046.8	3871	2719	1597	0.34	Se 2	
2139.8	3993	2883	1683	0.39	Se 3	
2245.0	4311	2968	1701	0.37	Se1	AS2
2395.0	4474	3181	1925	0.39	Se 2	
2516.1	4552	3314	2198	0.41	Se 3	
2609.3	4660	3420	2357	0.40	Se 1	AS3
2695.6	4763	3590	2429	0.41	Se 2	
2787.6	4894	3687	2569	0.44	Se 3	
170.32	209.2					LSD
Average						
2061.33	3886.66	2743.33	1615	0.35	AS1	W*AS
2385.42	4445.66	3154.33	1941.33	0.39	AS2	
2697.51	4772.33	3565.66	2451.66	0.41	AS3	
133.51	145.3					LSD
Average						
2283.92	4255.66	3005.33	1874.33	0.36	Se 1	W* Se
2379.17	4369.33	3163.33	1983.66	0.38	Se 2	
2481.18	4479.66	3294.66	2150.00	0.41	Se 3	
161.5	168.0					LSD
	4368.2	3154.4	2002.6	0.38		Average
	140.7					LSD

an increase of 8.62% compared to the control treatment that gave the least value 2283.92 mg.kg^{-1}. The third concentration of ascorbic acid was also significantly superior achieving the highest value 2697.51 mg.kg^{-1} exceeded the control treatment giving 2061.33 mg.kg^{-1} by 30.86%. The fourth treatment of lead-contaminated water was significantly superior in the concentration of the soil available lead giving 4368.2 mg.kg^{-1}. The interaction between the selenium element and contaminated water was significantly affected. The third concentration of selenium with the fourth treatment of water contamination giving the highest value 4479.66 mg.kg^{-1} was significantly superior to the others, where the lowest value was gotten from the control treatment (without spray with uncontaminated water) reaching 0.36 mg.kg^{-1}. The interaction between ascorbic acid and contaminated water was also affected the soil concentration in the soil. The third concentration combined with the fourth treatment of contaminated water gave the highest lead concentration 4772.33 mg.kg^{-1} compared to the lowest value 0.35 mg.kg^{-1} obtained from the control treatment (without spray plus uncontaminated water).

Regarding the tri interaction between selenium element, ascorbic acid and contaminated water, the interaction of third concentration of selenium and ascorbic acid combined with the fourth treatment of contaminated water was significantly superior giving the highest value 4894 mg.kg^{-1}, whereas the lowest value was obtained by the control 0.31 mg.kg^{-1}.

Lead concentration in hay (mg.kg^{-1} dry matter)

Results in table 3 demonstrate that the third concentration of selenium element gave the lowest value of lead concentration in the hay 75.32 mg.kg^{-1} dry matter, while the highest value was obtained by the control treatment (without spray) giving 82.02 mg.kg^{-1} dry matter and exceeded the third concentration by 8.89%. Lead concentration in the hay was also inecreased significantly as a result of adding the third concentration of ascorbic acid giving the lowest value 88.93 mg.kg^{-1} dry matter, whereas the treatment of without spray gave 66.82 mg.kg^{-1} dry matter, increasing over by 33.08%. The fourth treatment of contaminated water was significantly superior in this trait giving 143.72 mg.kg^{-1} dry matter, whereas the treatment of uncontaminated water gave 0.12 mg.kg^{-1} dry matter.

The interaction between the control treatment of selenium and the fourth concentration of contaminated water was significantly superior in the value of lead concentration in the hay 148.31 mg.kg^{-1} dry matter, while the lowest value was obtained by the treatment of third selenium concentration with uncontaminated water 0.09 mg.kg^{-1} dry matter. The interaction between ascorbic acid and contaminated water also affected significantly in this trait. The treatment of third concentration with the fourth treatment of contaminated water gave the highest lead concentration in the wheat hay 167.20 mg.kg^{-1} dry matter while the lowest value 0.08 mg.kg^{-1} dry matter was obtained by the treatment of third concentration of ascorbic acid combined by uncontaminated water. A significant superiority was noticed as a result of the tri interaction between selenium element concentration, ascorbic acid and contaminated water. The highest value of lead concentration was 171.36 mg.kg^{-1} dry matter found in the interaction between the third concentration of ascorbic acid with the fourth treatment of contaminated water and without spraying with selenium, while the lowest value 0.06 mg.kg^{-1} dry matter was obtained by the third concentration of both selenium element and ascorbic acid combined by uncontaminated water.

Table 3: Lead concentration in hay (mg.kg^{-1} dry matter).

AS*Se	W4	W3	W2	W1	Se	AS
70.32	120.50	86.10	74.50	0.20	Se 1	AS1
66.93	117.61	82.52	67.44	0.18	Se 2	
63.22	111.80	79.73	61.21	0.14	Se 3	
84.12	153.07	96.21	87.08	0.14	Se 1	AS2
80.46	148.15	91.76	81.86	0.10	Se 2	
76.64	140.74	87.43	78.32	0.08	Se 3	
91.61	171.36	100.38	94.61	0.11	Se 1	AS3
89.06	167.85	97.53	90.79	0.09	Se 2	
86.11	162.40	94.16	87.84	0.06	Se 3	
5.75	12.78					LSD
Average						
66.82	116.63	82.78	67.71	0.17	AS1	W*AS
80.41	147.32	91.80	82.42	0.11	AS2	
88.93	167.20	97.37	91.08	0.08	AS3	
2.70	10.70					LSD
Average						
82.02	148.31	94.23	85.93	0.15	Se 1	W* Se
78.82	144.53	90.60	80.03	0.12	Se 2	
75.32	138.31	87.10	75.79	0.09	Se 3	
3.91	8.11					LSD
	143.72	90.64	80.34	0.12		Average
	140.7					LSD

Lead concentration in grains (mg.kg^{-1} dry matter)

Results in table 4 refer that the third selenium concentration gave the lowest lead concentration in grains 21.87 mg.kg^{-1} dry matter with a significant difference compared to the others. The highest concentration of the lead in grains was 27.26 mg.kg^{-1} dry matter obtained when the plants were unsprayed by selenium. This value increased over the third concentration by 24.64%.

The third concentration of ascorbic acid differed significantly and gave the highest lead concentration in the grains 28.38 mg.kg^{-1} dry matter compared to the untreated plants giving the lowest value 23.57 mg.kg^{-1} dry matter exceeding the third ascorbic acid concentration by 15.19%. The fourth treatment of contaminated water significantly surpassed the other treatments in lead concentration in the grains being 40.69 mg.kg^{-1} dry matter, while the treatment of uncontaminated water gave the lowest lead concentration 0.04 mg.kg^{-1} dry matter. Regarding the interaction between selenium element and contaminated water, the interaction between the control treatment of selenium with the fourth treatment of contaminated water was significantly superior in this trait giving the highest lead concentration in the grains 42.48 mg.kg^{-1} dry matter, on the other hand, the lowest concentration 0.03 mg.kg^{-1} dry matter was produced by the control treatment of selenium with uncontaminated water. Concerning the interaction between ascorbic acid and contaminated water, the treatment of spraying with ascorbic acid and applying the fourth treatment of contaminated water gave the highest significantly differed concentration of lead in grains 44.14 mg.kg^{-1} dry matter, whereas the lowest value (0.03 mg.kg^{-1} dry matter) was gotten from the control treatment of ascorbic acid applied with uncontaminated water. The superiority of the tri interaction 46.38 mg.kg^{-1} dry matter was due to the third concentration ascorbic acid combined by the fourth treatment of contaminated water and without spraying with selenium element, while the lowest value 0.02 mg.kg^{-1} dry matter was found by the third concentration of selenium element without spraying ascorbic acid accompanied by uncontaminated water.

Table 4: Lead concentration in grains (mg.kg^{-1} dry matter).

AS*Se	W4	W3	W2	W1	Se	AS
24.92	39.33	34.57	25.74	0.04	Se 1	AS1
23.51	37.60	32.79	23.65	0.03	Se 2	
22.28	35.78	30.88	22.47	0.02	Se 3	
26.91	41.75	37.69	28.16	0.04	Se 1	AS2
25.77	40.60	35.41	27.03	0.07	Se 2	
24.22	38.49	32.61	25.73	0.07	Se 3	
29.97	46.38	40.08	33.42	0.03	Se 1	AS3
28.33	44.40	38.19	30.69	0.06	Se 2	
26.85	41.64	36.77	28.93	0.07	Se 3	
2.85	7.48					LSD
Average						
23.57	37.57	32.74	23.95	0.03	AS1	W*AS
25.63	40.28	35.23	26.97	0.06	AS2	
28.38	44.14	38.34	31.01	0.05	AS3	
						LSD
Average						
27.26	42.48	37.44	29.10	0.03	Se 1	W* Se
25.87	40.86	35.46	27.12	0.05	Se 2	
21.87	38.63	23.12	25.71	0.05	Se 3	
1.80	7.41					LSD
	40.69	35.44	27.31	0.04		Average
	5.48					LSD

Available cadmium concentration in soil after harvest (mg.kg^{-1})

Results in table 5 demonstrate the significant superiority of the selenium third concentration giving the highest available cadmium concentration in the soil after harvest 40.80 mg.kg^{-1} exceeding the control treatment (without spray) by 15.74% that gave 35.25mg.kg^{-1}. The third concentration of ascorbic acid was significantly superior in this trait giving the highest value reached 44.57mg.kg^{-1} exceeding the control, which gave 33.08 mg.kg^{-1}, by 34.73%. The fourth treatment of contaminated water was also superior in the available cadmium concentration in the soil 74.24 mg.kg^{-1}, while the treatment of uncontaminated water gave only 0.34 mg.kg^{-1}. The interaction between ascorbic acid and the fourth treatment of contaminated water affected significantly in the cadmium concentration in the soil reaching the highest concentration 78.99 mg.kg^{-1}, while the lowest value 0.24 mg.kg^{-1} was gotten from the treatment of non-spray with uncontaminated water. Regarding the tri interaction, the third concentration of selenium element, ascorbic acid and the fourth treatment of contaminated water gave a

Table 5: Available cadmium concentration in soil after harvest (mg.kg^{-1}).

AS*Se	W4	W3	W2	W1	Se	AS
30.61	67.00	39.11	16.13	0.20	Se 1	AS1
33.23	69.91	42.73	20.07	0.24	Se 2	
35.42	71.34	44.89	25.18	0.28	Se 3	
36.76	73.13	47.30	26.33	0.31	Se 1	AS2
38.45	74.22	50.12	29.14	0.33	Se 2	
40.46	75.60	53.36	32.50	0.32	Se 3	
42.40	76.43	58.19	34.60	0.41	Se 1	AS3
44.78	79.17	62.36	37.15	0.46	Se 2	
46.54	81.39	65.40	38.88	0.49	Se 3	
9.61	10.53					LSD
Average						
33.08	69.41	42.24	20.46	0.24	AS1	W*AS
38.55	74.31	50.26	29.32	0.34	AS2	
44.57	78.99	61.98	36.87	0.45	AS3	
4.10	14.93					LSD
Average						
35.25	72.18	48.20	20.31	0.31	Se 1	W* Se
38.82	74.43	51.73	28.78	0.34	Se 2	
40.80	76.11	54.55	32.18	0.38	Se 3	
2.70	13.70					LSD
	74.24	51.49	24.56	0.34		Average
	18.52					LSD

significant superiority in this trait producing the highest value (81.39 mg.kg^{-1}), while the lowest value was 0.20 mg.kg^{-1} gotten from the treatment of without spray accompanied uncontaminated water.

Cadmium concentration in hay (mg.kg^{-1} dry matter)

Results in table 6 demonstrate that the third concentration of selenium element gave the lowest value of Cadmium concentration in the hay 12.83 mg.kg^{-1} dry matter, while the highest value was obtained by the control treatment (without spray) giving 14.80 mg.kg^{-1} dry matter and exceeded the third concentration by 15.35%. Cadmium concentration in the hay was also inecreased significantly as a result of adding the third concentration of ascorbic acid giving the highest value 15.55 mg.kg^{-1} dry matter, whereas the treatment of without spray gave 11.41 mg.kg^{-1} dry matter, increasing over by 36.28%. The fourth treatment of contaminated water was significantly superior in this trait giving 22.31 mg.kg^{-1} dry matter, whereas the treatment of uncontaminated water gave 0.12 mg.kg^{-1} dry matter. The interaction between the control treatment of selenium and the fourth concentration of contaminated water was significantly superior in the value of Cadmium concentration in the hay 23.78 mg.kg^{-1} dry matter, while the lowest value was obtained by the treatment of third selenium concentration with uncontaminated water 0.09 mg.kg^{-1} dry matter.

The interaction between ascorbic acid and contaminated water also affected significantly in this trait. The treatment of third concentration with the fourth treatment of contaminated water gave the highest Cadmium concentration in the wheat hay 24.38 mg.kg^{-1} dry matter while the lowest value 0.11 mg.kg^{-1} dry matter was obtained by the treatment of third concentration of ascorbic acid combined by uncontaminated water. A significant superiority was noticed as a result of the tri interaction between selenium element concentration, ascorbic acid and contaminated water. The highest value of Cadmium concentration was 25.31 mg.kg^{-1} dry matter found in the interaction between the third concentration of ascorbic acid with the fourth treatment of contaminated water and without spraying with selenium, while the lowest value 0.08 mg.kg^{-1} dry matter was obtained by the third concentration of both selenium element and ascorbic acid combined by uncontaminated water.

Cadmium concentration in grains (mg.kg^{-1} dry matter)

Results in table 7, illustrate that the third concentration of selenium significantly decreased the cadmium concentration in grains to be 1.68 mg.kg^{-1} dry matter, while the highest concentration 2.07 mg.kg^{-1} dry matter, which exceeded the third concentration by 18.84 %, was obtained by the treatment of without spraying with selenium. The third concentration of ascorbic acid was led to a increased in this trait reaching the highest value 2.06 mg.kg^{-1} dry matter, while the treatment of without

Table 6: Cadmium concentration in hay (mg.kg^{-1} dry matter).

AS*Se	W4	W3	W2	W1	Se	AS
13.1	21.64	16.20	14.36	0.20	Se 1	AS1
11.29	18.89	13.86	12.29	0.15	Se 2	
9.85	16.63	11.77	10.91	0.10	Se 3	
15.25	24.41	19.61	16.83	0.16	Se 1	AS2
14.00	23.18	17.09	15.61	0.12	Se 2	
13.57	22.94	16.43	14.81	0.10	Se 3	
16.08	25.31	20.14	18.74	0.13	Se 1	AS3
15.52	24.08	19.89	18.02	0.11	Se 2	
15.10	23.75	18.92	17.67	0.08	Se 3	
1.24	3.13					LSD
Average						
11.41	19.05	13.94	12.52	0.15	AS1	W*AS
14.27	23.51	17.71	15.75	0.13	AS2	
15.55	24.38	19.59	18.14	0.11	AS3	
2.44	2.10					LSD
Average						
14.80	23.78	18.65	16.64	0.16	Se 1	W* Se
13.60	22.05	16.94	15.30	0.13	Se 2	
12.83	21.10	15.70	14.46	0.09	Se 3	
1.91	2.09					LSD
	22.31	17.10	15.47	0.12		Average
	2.00					LSD

Table 7: Cadmium concentration in grains (mg.kg^{-1} dry matter).

AS*Se	W4	W3	W2	W1	Se	AS
1.97	3.20	2.44	1.81	0.43	Se 1	AS1
1.89	3.16	2.38	1.63	0.40	Se 2	
1.59	2.59	2.10	1.28	0.39	Se 3	
2.02	3.31	2.48	1.90	0.40	Se 1	AS2
1.90	3.20	2.16	1.81	0.36	Se 2	
1.72	3.11	2.00	1.45	0.33	Se 3	
2.23	3.66	2.91	1.99	0.37	Se 1	AS3
2.01	3.41	2.53	1.78	0.35	Se 2	
1.76	2.96	2.21	1.55	0.34	Se 3	
0.22	0.43					LSD
Average						
1.81	2.98	2.30	1.57	0.47	AS1	W*AS
1.87	3.20	2.21	1.72	0.36	AS2	
2.06	3.34	2.80	1.77	0.35	AS3	
0.24	0.41					LSD
Average						
2.07	3.39	2.61	1.90	0.40	Se 1	W* Se
1.92	3.25	2.35	1.74	0.37	Se 2	
1.68	2.88	2.10	1.42	0.35	Se 3	
0.20	0.39					LSD
	3.17	2.35	1.68	0.37		Average
	0.51					LSD

spray gave the lowest concentration 1.81mg.kg^{-1} dry matter. The fourth treatment of contaminated water was significantly superior in the cadmium concentration in the grains reaching 3.17 mg.kg^{-1} dry matter, while the lowest concentration value 0.37 mg.kg^{-1} dry matter was obtained by the treatment of uncontaminated water. Regarding the interaction between selenium element and contaminated water, the interaction between the control treatment of selenium and the fourth treatment of contaminated water was superior in the trait giving the highest value of cadmium concentration 3.39 mg.kg^{-1} dry matter, while the interaction between the third concentration of selenium and uncontaminated water gave the lowest cadmium concentration in the grains 0.35 mg.kg^{-1} dry matter. The interaction between ascorbic acid and contaminated water also affected significantly. The interaction between the third concentration by the fourth treatment of contaminated water gave the highest cadmium concentration in the grains 3.34 mg.kg^{-1} dry matter, while the lowest concentration value 0.35 mg.kg^{-1} dry matter was achieved by the interaction between the third concentration of ascorbic acid and the treatment of uncontaminated water.

The significant superiority of tri interaction giving the highest value of cadmium concentration 3.66 mg.kg^{-1} dry matter was obtained by the interaction of the third concentration of ascorbic acid, the fourth treatment of contaminated water and without spraying with selenium, whereas the interaction of the third concentration of selenium, the second concentration of ascorbic acid and uncontaminated water gave the lowest cadmium concentration value 0.33 mg.kg^{-1} dry matter.

Discussion

The increment in lead and cadmium concentrations in the soil is attributed to their concentration in the contaminated water leading to accumulating them in the soil. This is consistent with Yobout, (2010) who referred to that increasing heavy elements in soil increases their availability, this, in turn, is in line with the findings of Abdulateef, (2016) and Ouda, (2018). As a result, it increased the absorption of these elements by the wheat plant as some plants have the ability to accumulating heavy elements in their parts. (Hamidoush, 2014), so the heavy elements accumulated in vegetative parts is directly proportional to the increase of concentrations of these elements in the soil in which the plants live (Azita and Seid, 2008). Selenium element with ascorbic acid participated in decreasing the stress damages affected by heavy elements through reducing the transfer of lead and cadmium from roots to other plant part where selenium help to stress tolerance through several mechanisms including, it is an enzymatic anti-oxidant contributes to the major part formation of the glutathione peroxidase enzyme which removes the free radicals, in particular, converts the two molecules of hydrogen peroxide into two water molecules (Sies and Brigelius, 2016), moreover it plays an important role in protecting the enzymatic system of anti-oxidation and increasing the enzymatic activity of catalase, peroxidase and super peroxidase that have a huge role in removing the free radicals. Selenium also acts as a non-enzymatic anti-oxidants through its ability to inhibit magnetic momentum of free radicals, because of that one of the rare qualities of selenium is the reverse magnetics phenomenon related to the creation of a magnetic field opposed to any other external magnetic field and since the free radicals have harmful magnetic momentum destructive of electronic balance, this reduces the magnetic momentum of the free roots and consequentially, selenium prohibits the free radicals (Pal *et al.*, 2013). On the other hand, ascorbic acid increases the concentration of phenols in plants (Farouk, 2011; Al-Alawy, 2015). Phenols act as chelate z bind to the heavy elements and make them physiologically ineffective or deposit them in the cell wall (Al-Wahibi, 2007); furthermore, ascorbic acid has a role similar to that of promotive growth regulators that increase the shoot and root systems (Abdul Adheem, 2017). Thus increasing the absorption of nutrient elements, including microelements that have a role in stabilizing the process of transmission of heavy elements absorbed by the roots to the vegetative parts (AL-Jumaily, 2010).

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