

## EFFECT OF GARLIC AND LICORICE ROOT EXTRACT ON LEAVES MINERAL AND HORMONAL CONTENT OF PEAR TRANSPLANTS

M. A. Shakir

W. A. A. Al-Rawi

Researcher

Prof.

Dept. Of Hort. and Landscape- Coll. of Agric. – Univ. of Baghdad

Waleed\_dac1@yahoo.com

### ABSTRACT

This research was conducted during the growing season 2015 - 2016 to investigate the response of 2 year's old transplants of "Othmani" pear cultivar budded on Calleryana root stock to foliar application with licorice root extract at four levels 0 (Li<sub>0</sub>), 2.5 g.L<sup>-1</sup> (Li<sub>2.5</sub>), 5 g.L<sup>-1</sup> (Li<sub>5</sub>) and 10 g.L<sup>-1</sup> (Li<sub>10</sub>) and garlic extract at four levels, 0 (GA<sub>0</sub>), 5ml.L<sup>-1</sup> (GA<sub>5</sub>), 10ml.L<sup>-1</sup> (GA<sub>10</sub>) and 20ml.L<sup>-1</sup> (GA<sub>20</sub>) and their interaction in leaves mineral and hormonal content . Each treatment was replicated three times using a factorial experiment using RCBD. The number of trees used was 96 trees. The results showed that the interaction between spraying garlic extract at 20 ml .L<sup>-1</sup> combined with licorice root extract at 10 g .L<sup>-1</sup> (GA<sub>20</sub>Li<sub>10</sub>) gave a high value of leaves nitrogen content at 1.35 and 1.83%, potassium content at 2.410 and 2.592%, iron content at 210.3 and 234.5 mg. Kg<sup>-1</sup> and highest leaves zinc content at 18.00 and 20.22 mg. Kg<sup>-1</sup> for both seasons, respectively. As well as for hormones, GA<sub>20</sub>Li<sub>10</sub> treatment was given the highest leaves content of IAA at 41.73 and 46.52 µg.g<sup>-1</sup> and the highest leaves GA<sub>3</sub> content with 229.8 and 259.4 µg.g<sup>-1</sup> for both seasons respectively. The lowest value of these parameters was found in the control (GA<sub>0</sub>Li<sub>0</sub>) treatment.

Key words: Plant extracts, Leaf mineral content, Leaf hormonal content, Pear, Transplants.

شاكر والراوي

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تأثير مستخلص الثوم و جذور عرق السوس على المحتوى المعدني و الهرموني لشتلات الكمثرى

وليد عبد الغني احمد الراوي

محمد عبد الحميد شاكر

استاذ

باحث

قسم البستنة و هندسة الحدائق – كلية الزراعة – جامعة بغداد

Waleed\_dac1@yahoo.com

المستخلص

أجريت هذه التجربة في موسمي النمو 2015 و 2016 لدراسة استجابة شتلات الكمثرى صنف عثمانى بعمر سنتين والمطعمة على الأصل Calleryana للرش بأربعة مستويات من مستخلص جذور عرق السوس (Li) هي صفر (Li<sub>0</sub>) و 2.5 (Li<sub>2.5</sub>) و 5 (Li<sub>5</sub>) و 10 (Li<sub>10</sub>) غم. لتر<sup>-1</sup> وأربعة مستويات من مستخلص الثوم هي صفر (GA<sub>0</sub>) و 5 (GA<sub>0</sub>) و 10 (GA<sub>0</sub>) و 20 (GA<sub>0</sub>) مل. لتر<sup>-1</sup> والتداخل فيما بينهما في المحتوى المعدني و الهرموني للأوراق. صممت المعاملات بتجربة عاملية بتصميم القطاعات الكاملة المعشاة بثلاثة مكررات بواقع شتلتين لكل وحدة تجريبية وبذلك يكون عدد الشتلات الداخلة في التجربة 96 شتلة. أظهرت النتائج أن معاملة التداخل GA<sub>20</sub>Li<sub>10</sub> قد تفوقت على باقي المعاملات حيث أعطت أعلى محتوى للأوراق من النتروجين بلغ 1.35 و 1.83% والبيوتاسيوم بلغ 2.410 و 2.592%، الحديد بلغ 210.3 و 234.5 ملغم.كغم<sup>-1</sup> وأعلى محتوى للأوراق من الزنك بلغ 18.00 و 20.22 ملغم.كغم<sup>-1</sup> لموسمي الدراسة، بالتتابع. كذلك الحال بالنسبة للهرمونات فقد أعطت معاملة التداخل GA<sub>20</sub>Li<sub>10</sub> أعلى محتوى للأوراق من الأوكسين بلغ 41.73 و 46.52 مايكروغرام.غم<sup>-1</sup> وأعلى محتوى للأوراق من الجبرلين بلغ 229.8 و 259.4 مايكروغرام.غم<sup>-1</sup> للموسمين، بالتتابع. كانت أقل القيم لهذه القياسات في معاملة المقارنة GA<sub>0</sub>Li<sub>0</sub>.

الكلمات المفتاحية: مستخلصات نباتية، المحتوى المعدني للورقة، الهرموني، الكمثرى، الشتلات.

## INTRODUCTION

The genus *Pyrus*, (pears) includes a wide range of species used partially as rootstocks but not or very rarely as human food. The genus *Pyrus* is a part of the family Rosacea with (2N) chromosomes (6), Japanese pear which are commercially cultivated in temperate zone (15). The acreage of pear in the world reached about 1766984.00 hectare, with production of 25203754 tons (14). The main producing countries are China then Italy, Argentina, India, Japan (14). The estimated number of pear fruit trees in Iraq, including nearly 547508 tree produces up to 14326 tons, and the average production per tree about 26.2 kg (7). The use of natural products in horticultural practices instead of synthetic chemical products is becoming as a main target for many fruit crop producers, where the world market has been growing rapidly in recent years for organic fruit production (9). The licorice extract contain more than 100 various compounds, some of which accumulated in large amounts, which most important of them are triterpene Saponins (including glycyrrhizin) and phenolic compounds (18, 20). The yellow color of licorice is due to the flavonoid content of the plant, which includes liquiritin, isoliquiritin and other compounds. The isoflavones glabridin and hispaglabridins A and B have significant antioxidant activity. In addition, licorice extract contain protein and amino acid (Asparagin), monosaccharide (glucose, fructose, sucrose and maltose), lignins, tannins, starch, choline, phytosterols, different types of vitamins such as B1, B2, B3, B6, C, E, biotin, folic acid, pantothenic acid, many mineral compounds (aluminum, calcium, iron, magnesium, cobalt, zinc, phosphorus, sodium, silicone, potassium and stannous) and bitter principles (4, 20). Previous studies emphasized the beneficial effects of licorice root extracts on leaf mineral and hormonal content (1, 2 and 3) in fruit trees. Garlic (*Allium sativum*) extract contains enzymes and more than 200 chemical compounds, some of its volatiles are more important i.e. Allicin that gives garlic its antibiotic properties. Its higher contents of volatile and sulphur compounds put both in the top due to their real and essential roles they play in fruiting process of various fruit trees

(5). Garlic also contains vitamins, minerals, flavonoids, ascorbic acid, sulphur and trace of iodine. Seventeen amino acids are found in garlic, including eight essential ones. The effect of garlic extract on leaves mineral content has been interpreted by Abd El-Hamied and El-Amary (1) and El-Sharony *et al.* (11). They reported that garlic extract showed comparatively greater efficacy on nutrition and hormonal status of pear and mango respectively. The objective of this study was to evaluate leaves mineral and hormonal content of "Othmani" pear cultivar under using licorice and garlic extract spray under Iraq conditions.

## MATERIAL AND METHODS

This study was conducted in a private orchard in the Ghazaliya city west of Baghdad during 2015/ 2016 growing seasons to investigate the influence of licorice root extract and garlic extract spray on 2 year's old transplants "Othmani" pear cultivar. Trees were cultivated at 2.5 X 2.5 m under drip irrigation system. Trees were similar in vigor and subjected to the same horticultural practices adapted in the region. This study included the following treatments: four levels of spraying of licorice root extract, 0 (Li<sub>0</sub>), 2.5 g.L<sup>-1</sup> (Li<sub>2.5</sub>), 5 (Li<sub>5</sub>) and 10 g.L<sup>-1</sup> (Li<sub>10</sub>) and four levels of spraying of garlic extract, 0 (GA<sub>0</sub>), 5ml.L<sup>-1</sup> (GA<sub>5</sub>), 10ml.L<sup>-1</sup> (GA<sub>10</sub>) and 20ml.L<sup>-1</sup> (GA<sub>20</sub>) and their interaction. Treatments were replicated three times in a factorial experiment using a Randomized Completely Block Design, with two transplants in each experimental unit. The number of transplants used was 96 transplants. The leaf minerals content was analyzed at the two successive seasons: Leaf Mineral Content: Leaf samples were collected for chemical analysis at the 1<sup>st</sup> week of June at both seasons. Each sample was consisted of 20 leaves / tree. Leaves were washed several times with tap water, rinsed with distilled water, and then dried at 70 C<sup>0</sup> until a constant weight, ground and digested according to Chapman and Pratt (8). Nitrogen was estimated by semi-micro Kjeldahl method of Plummer (17). Phosphorus was determined by the method outlined by Jackson (12). Potassium was determined using atomic absorption spectrophotometer after samples digestion according to Chapman and Pratt (8).

Iron, Manganese and Zinc were determined as (mg.Kg<sup>-1</sup>) using atomic absorption according to Page *et al.*, (16). Hormones were analyzed according to Unyayar *et al.* (19). The obtained results were subjected to analysis of variance according to Elshookie and Wuhaib (10) using L.S.D 0.05 for comparing differences between various treatment means.

## RESULT AND DISCUSSION

**Effect of Garlic and Licorice extracts spray on Leaves Mineral Content:** Results shown in Tables 1 and 2 nitrogen, phosphorus, potassium, iron, zinc and manganese content in the leaves were significantly affected by all treatments in both seasons, with the exception of phosphorus, which affected but not significantly. However, spraying trees with licorice extract at 10 g .L<sup>-1</sup> combined with garlic extract at 20ml.L<sup>-1</sup> gave the highest leaves nitrogen content (1.35 and 1.83%), highest leaves potassium content (2.410 and 2.592%), highest leaves iron content (210.3 and 234.5 mg. Kg<sup>-1</sup>), highest leaves zinc

content (18.00 and 20.22 mg. Kg<sup>-1</sup>) and highest leaves manganese content (2.106 and 2.307 mg. Kg<sup>-1</sup>) for both seasons, respectively. On the other hand, control was the lowest in leaves content in minerals.

**Effects of Garlic and Licorice extract spray on Leaves hormonal content:** It is evident from the obtained data Table 3 that combined application of licorice and garlic extracts significantly improved the leaves IAA content, leaves GA<sub>3</sub> content and leaves Zeatin content compared to control treatment. Results indicated that the combination between licorice and turmeric extracts displayed that 10 (L<sub>10</sub>) g.L<sup>-1</sup> and 20(GA<sub>20</sub>) ml.L<sup>-1</sup> as it gave the highest leaves IAA content with 41.73 and 46.52 µg.g<sup>-1</sup> and the highest leaves GA<sub>3</sub> content with 229.8 and 259.4 µg.g<sup>-1</sup> and the highest leaves Zeatin content with 44.34 and 47.92 µg.g<sup>-1</sup> for both seasons respectively. While the trees that were not sprayed exhibited lowest content of hormones in their leaves.

**Table 1. Effects of Garlic and Licorice root extract spray on Leaves content of N, P and K Othmani pear transplants during 2015 and 2016 seasons**

Season	2015					2016				
	GA	Li				Li				
	0	2.5	5	10	mean	0	2.5	5	10	mean
N %										
0	1.23	1.24	1.27	1.29	1.26	1.34	1.37	1.40	1.43	1.38
5	1.25	1.28	1.29	1.30	1.28	1.40	1.46	1.49	1.54	1.47
10	1.29	1.28	1.30	1.32	1.30	1.52	1.55	1.62	1.69	1.60
20	1.29	1.31	1.34	1.35	1.32	1.60	1.68	1.79	1.83	1.73
Means	1.26	1.28	1.30	1.32		1.47	1.52	1.58	1.62	
L.S.D5%	GA	Li	Inter			GA	Li	Inter		
	0.017	0.017	0.034			0.048	0.048	0.096		
P %										
0	0.314	0.316	0.320	0.320	0.318	0.328	0.337	0.339	0.345	0.337
5	0.317	0.321	0.322	0.325	0.321	0.336	0.34	0.344	0.347	0.342
10	0.322	0.324	0.327	0.326	0.325	0.339	0.348	0.352	0.361	0.35
20	0.329	0.336	0.330	0.338	0.333	0.350	0.342	0.336	0.363	0.348
Means	0.321	0.324	0.325	0.327		0.338	0.342	0.343	0.354	
L.S.D5%	GA	Li	Inter			GA	Li	Inter		
	N.S	N.S	N.S			N.S	N.S	N.S		
K %										
0	1.882	1.897	1.996	2.101	1.969	1.890	1.992	2.187	2.215	2.071
5	1.936	1.968	2.117	2.243	2.066	2.119	2.280	2.360	2.481	2.310
10	1.995	2.170	2.228	2.250	2.161	2.127	2.297	2.398	2.514	2.334
20	2.078	2.251	2.367	2.410	2.279	2.214	2.328	2.490	2.592	2.406
Means	1.975	2.072	2.177	2.251		2.088	2.224	2.359	2.451	
L.S.D5%	GA	Li	Inter			GA	Li	Inter		
	0.062	0.062	0.124			0.077	0.077	0.154		

**Table 2. Effects of Garlic and Licorice root extract spray on Leaves Fe, Zn and Mn content of Othmani pear transplants during 2015 and 2016 seasons**

Season	2015					2016				
GA	Li					Li				
	0	2.5	5	10	mean	0	2.5	5	10	mean
	Fe (mg. Kg <sup>-1</sup> )									
0	143.2	148.7	156.2	159.3	151.9	151.8	164.6	166.9	182.6	166.5
5	150.0	155.6	164.9	177.5	162.0	159.2	172.6	189.0	197.3	179.5
10	162.2	171.4	188.8	196.6	179.8	170.0	192.8	208.6	216.9	197.1
20	173.7	182.9	202.1	210.3	192.3	184.2	219.0	227.8	234.5	216.4
Means	157.3	164.7	178.0	185.9		166.3	187.3	198.1	207.8	
L.S.D5%	GA	Li	Inter			GA	Li	Inter		
	9.24	9.24	18.48			11.15	11.15	22.30		
	Zn (mg. Kg <sup>-1</sup> )									
0	16.11	16.38	16.67	16.96	16.53	16.29	16.56	16.87	17.17	16.72
5	16.31	16.52	16.93	17.13	16.72	16.52	16.83	17.00	17.54	16.97
10	16.75	17.02	17.08	17.67	17.13	16.92	16.85	17.26	18.11	17.29
20	17.18	17.56	17.62	18.00	17.59	17.34	17.73	18.37	20.22	18.42
Means	16.59	16.87	17.08	17.44		16.77	16.99	17.38	18.26	
L.S.D5%	GA	Li	Inter			GA	Li	Inter		
	0.47	0.47	0.94			0.53	0.53	1.06		
	Mn (mg. Kg <sup>-1</sup> )									
0	1.752	1.770	1.776	1.799	1.774	1.786	1.795	1.810	1.869	1.815
5	1.765	1.786	1.792	1.814	1.789	1.799	1.812	1.856	1.954	1.855
10	1.780	1.854	1.899	1.923	1.864	1.826	1.910	1.998	2.115	1.962
20	1.809	1.921	1.995	2.106	1.958	1.967	2.109	2.118	2.307	2.125
Means	1.777	1.833	1.866	1.911		1.845	1.907	1.946	2.061	
L.S.D5%	GA	Li	Inter			GA	Li	Inter		
	0.071	0.071	0.142			0.059	0.059	0.118		

**Table 3. Effects of Garlic and Licorice root extract spray on Leaves IAA, GA<sub>3</sub> and Zeatin content of Othmani pear transplants during 2015 and 2016 seasons**

Season	2015					2016				
GA	Li					Li				
	0	2.5	5	10	mean	0	2.5	5	10	mean
	IAA (µg·g <sup>-1</sup> )									
0	27.76	28.11	28.67	29.12	28.42	28.56	28.59	29.05	29.78	29.00
5	28.20	28.37	28.99	29.67	28.81	29.73	30.11	32.34	35.87	32.01
10	29.19	29.51	29.87	31.65	30.06	31.78	33.25	34.17	38.70	34.48
20	30.88	33.19	37.52	41.73	35.83	33.98	38.19	40.42	46.52	39.78
Means	29.01	29.80	31.26	33.04		31.01	32.54	34.00	37.72	
L.S.D5%	GA	Li	Inter			GA	Li	Inter		
	1.07	1.07	2.14			2.26	2.26	4.52		
	GA <sub>3</sub> (µg·g <sup>-1</sup> )									
0	106.5	117.8	128.7	136.9	122.5	103.2	124.2	135.7	143.8	126.7
5	112.2	132.6	144.8	159.5	137.3	110.7	146.8	159.7	188.1	151.3
10	121.3	148.8	175.7	196.6	160.6	122.7	180.0	216.3	229.3	187.1
20	129.6	169.6	201.5	229.8	182.6	133.1	210.0	244.8	259.4	211.8
Means	117.4	142.2	162.7	180.7		117.4	165.3	189.1	205.2	
L.S.D5%	GA	Li	Inter			GA	Li	Inter		
	39.19	39.19	78.38			43.22	43.22	86.44		
	Zeatin (µg·g <sup>-1</sup> )									
0	37.26	37.86	38.14	39.00	38.07	38.03	38.67	38.88	39.40	38.75
5	37.84	38.19	38.86	39.56	38.61	38.61	39.16	39.63	39.72	39.28
10	38.96	39.87	40.41	43.52	40.69	39.39	40.27	41.62	43.85	41.28
20	40.18	41.73	41.94	44.34	42.05	41.18	42.89	44.11	47.92	44.03
Means	38.56	39.41	39.84	41.61		39.30	40.25	41.06	42.72	
L.S.D5%	GA	Li	Inter			GA	Li	Inter		
	1.42	1.42	2.84			1.56	1.56	3.12		

This result could be due to the important role of licorice extract that contain a profile of proteins, and the amino acid (Asparagin), monosaccharide, many minerals compounds (aluminum, calcium, iron, magnesium, cobalt, zinc, phosphorus, sodium, silicone, potassium and stannous) and bitter principles, which play an important role in the leaf minerals and hormonal content (4, 20). This may be due to the behavior of the extract is similar to gibberellin as a result of it contains a compound Mevalonic acid also leads to improve vegetative growth and leaf minerals and hormonal content stimulated as a result of the enzymes needed to convert complex compounds into simple ones then converting energy for growth. These results are agree with Al-Hadethi *et al.*, (3) who found that spraying of pear transplants with licorice extract at 4 mg.L<sup>-1</sup> potentially increased the content of nitrogen and potassium in leaves. Abd El-Hamied and El-Amary (1) were found that spray of pear transplants with licorice extract at 4 mg.L<sup>-1</sup> potentially increased the content of, N and K in leaves. These results may due to the role of garlic extract, which contains vitamins, minerals, flavonoids, ascorbic acid, sulphur and traces of iodine. Seventeen amino acids are found in garlic, including eight essential ones. These results are parallel with (13) who found that spraying olive transplants with garlic extract at 50 mg.L<sup>-1</sup> increased the content of nitrogen and potassium in leaves. Abd El-Hamied and El-Amary (1) also found that spraying pear transplants with garlic extract at 4% increased the content of, N and K in leaves.

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