RESPONSE OF HAWTHORN TRANSPLANTS TO BIOFERTILIZERS AND POULTRY MANURE

M. E.A. Al-Hadethi
Lecturer
Dept. of Hort. and Landscape- Coll. of Agric. – University of Baghdad
mukhtarmustafa@yahoo.com

ABSTRACT

This study was conducted in lath house, Dept. of Horticulture and Landscape Gardening, Coll. of Agricultural Engineering Sciences – Univ. of Baghdad during 2017 / 2018 growing seasons to investigate the influence of biofertilizers and poultry manure on 2 year's old trees of hawthorn transplants. This study included two treatments: four types of biofertilizers control (B_1), *Azospirillum brasilense* (B_2), *Bacillus megatherium* (B_3) and *A. brasilense* + *B. megatherium* (B_4) and three levels of poultry manure , 0 (M_0), 250g.tree^{-1} (M_{250}) and 500g.tree^{-1} (M_{500}) and their interactions. Treatments were replicated four times at factorial experiment in a RCBD. The experimental results showed that biofertilizers treatment (B_4) gave the highest leaves number of 72.42 and 77.83 leaf.plant^{-1}, highest leaf nitrogen content of 1.62 and 1.75 % and highest leaf IAA content of 34.41 and 38.85 µg g^{-1} FW, for both seasons, respectively. Results also showed that poultry manure at levels 500g.tree^{-1} (M_{500}) was superiority on control treatment and gave the highest leaves chlorophyll content of 59.19 and 59.96 SPAD units and highest leaf GA content of 139.46 and 140.76 µg. g^{-1} FW, for both seasons, respectively.

Key words: fertilizers, organic manure, growth, leaves mineral, fruit trees.

استجابة شتلات الزعرور للأسمدة الحيوية و مخلفات الدواجن

مصطفى عيادة عداي الحديثي
مدرس
قسم البستنة وهندسة الحدائق – كلية علوم الهندسة الزراعية – جامعة بغداد

المستخلص

أجريت هذه التجربة في الظلة التابعة لقسم البستنة و هندسة الحدائق / كلية علوم الهندسة الزراعية / جامعة بغداد للموسمين 2017 و 2018 لمعرفة تأثير اضافة الأسمدة الحيوية و مخلفات الدواجن في شتلات الزعرور بعمر 2 سنة. تضمنت التجربة عاملين، الأول هو اضافة اربعة انواع من الأسمدة الحيوية هي المقارنة (B_1) و اضافة *Azospirillum brasilense* (B_2) واضافة *Bacillus megatherium* (B_3) و اضافة *A. brasilense* + *B. megatherium* (B_4) واضافة ثلاثة مستويات من مخلفات الدواجن هي صفر (M_0)، 250 غم.شتلة$^{-1}$ (M_{250})، 500 غم.شتلة$^{-1}$ (M_{500}) والتداخل فيما بينهما. صممت التجربة بتصميم التجارب العاملية ضمن تصميم RCBD وبأربعة مكررات. اظهرت نتائج التجربة ان الأسمدة الحيوية (B_4) اعطت اعلى عدد للأوراق والبالغ 72.42 و77.83 ورقة، اعلى محتوى للأوراق من النتروجين والبالغ 1.62 و1.75 % ومن IAA والبالغة 34.41 و38.85 مايكروغرام.غرام$^{-1}$ وزن طري لموسمي الدراسة، بالتتابع. كما اظهرت النتائج ايضاً تفوق المعاملة (M_{500}) على معاملة المقارنة واعطت اعلى محتوى للأوراق من الكلوروفيل والبالغ 59.19 و59.96 وحدة Spad واعلى محتوى للأوراق GA والبالغة 139.46 و140.76 مايكروغرام.غرام$^{-1}$ وزن طري لموسمي الدراسة، بالتتابع.

الكلمات المفتاحية: الأسمدة ، سماد عضوي، النمو، العناصر في الأوراق، اشجار الفاكهة.

***Received:13/9/2018, Accepted:10/1/2019**

INTRODUCTION

Hawthorn, (*Crategus azarolus* L.) is a fruit tree, belong to Rosaceae family. Medium-sized trees are taller than 8m. Its white flowers and spherical fruits contain 2-3 seeds. Hawthorn consists of about 100 species, are found in temperate regions in Central Europe. In Iraq, there are two types of Hawthorn in the wild *Crategus azarolus* L. and *C. monigyna* L, in addition to other rare species *C. meyeri, C. pentagyna* and *C. netrophylla* (7). Hawthorn juice contains vitamin C, which is a favorite fruit for children. The fresh fruit contains citric acid, pectin and sugar (glucose, fructose). Their wood can be used in manufacture of furniture. Studies showed that hawthorn contains antioxidants (Procyandins and quercetin) , which fight against free radicals that cause cell membranes damage and genetic mutations, and can also cause cell death. Scientists consider these free radicals responsible for many events that affect the body with aging such as wrinkles, as well as many diseases such as cancer, cardiovascular disease (CVD) (18 and 22). As a result of increase chemical fertilizers in the recent years and the likelihood of negative effects on soil pollution, groundwater and atmosphere, and potential damage to human health , animal and microorganisms, as well as economic losses due to loss of chemical fertilizers. Scientists have sought alternative methods for chemical fertilization which are safer on human health and do not cause environmental pollution. An alternative is use of biotechnology to solve these problems. Biotechnologies include the use of organisms, part of a living organism, or organic and inorganic products from an organism used to perform a specific function (16). Biofertilizers are microbial fertilizers often increasing the biological activity of the soil. The most important function of these organisms is to convert atmospheric nitrogen into plant-usable forms, biodegradable bacterial fertilizers reducing the rate of chemical phosphate fertilization, reducing soil and environmental pollution as well as increasing production, quality, and increasing soil fertility (5). Several studies have been conducted to determine the role of biofertilizers in growth, leaf mineral and hormonal content, Nithya *et al*, 2011 (19) mentioned that *Azotobacter* and *Aspergillus* spp caused a significant increase in vegetative growth on (pairedV-1) mulberry trees. Al-Hadethi, 2015 (3) , studied the effect of five of fertilizer sources (no application, 15 g.tree^{-1} of Phosphorene biofertilizer, 15 g.tree^{-1} of Nitrobeine biofertilizer , 15 g.tree^{-1} of both Phosphorene + Nitrobeine and NPK fertilizer as recommended on apricot trees) and found Phosphorene + Nitrobeine and NPK caused significant increases in stem diameter, shoot growth , leaf chlorophyll content, leaf N, P, K contents and leaves endogenous hormones (IAA, GA_3 and Zeatin) in apricot trees. Abo AL-Mikh, (2) Recorded that, highest plant height, leaves number, leaves dry weight and leaves N, P, K, content it was in Wonderful pomegranate trees treated biofertilizers. Al-Hadethi *et al*, 2017 (4), found that the addition of bio-fertilizers to Peento peach transplants gave the highest leaves area, leaves chlorophyll content and increase in stem diameter. Organic fertilizers play a role in reducing the nitrogen loss during decomposition and facilitate the movement of nutrients to the roots to be absorbed and benefit from them, poultry manures have the most concentrated nutrient content compared to other animal manures, and are cheaper in cost (6). Poultry manures affect the growth of fruit trees, AL- Obaidi, (8) mentioned that the poultry manure applied with 4, 6 and 8 kg.tree^{-1} caused a significant increase in vegetative growth, leaves dry weight and leaves mineral content compared to the control treatment from his study on apricot trees (cv. Zaini). Hamad and Abd, (14) found that poultry manure at 1, 2 and 3 kg.tree^{-1} caused significant increases in leaves dry weight, chlorophyll content, leaves area and leaves potassium content for two pomegranate types Salimi and Wonderful. Kakehzadeh *et al*, (15) recorded that the highest increase in trunk diameter, annual shoot length and tree height was in the apple trees treated with poultry manure. Due to the absence of studies on hawthorn transplants and the effect of organic and bio fertilizers on their growth, the present study was conducted.

MATERIALS AND METHODS

This study was conducted in lath house, Department of Horticulture and Landscape

Gardening, College of Agricultural Engineering Sciences – University of Baghdad- Al-Jadriya during 2017 / 2018 growing seasons to investigate the influence of biofertilizers and poultry manure on 2 year's old trees of hawthorn transplants. This study included two treatments: four types of biofertilizers **control (B_1),** ***Azospirillum brasilense*** (**B_2**), ***Bacillus megatherium*** (**B_3**) and ***Azospirillum brasilense*** + ***Bacillus megatherium*** (**B_4**) and three levels of poultry manure **, 0 (M_0), 250g.tree^{-1} (M_{250})** and **500g.tree^{-1} (M_{500})** and their interactions. Treatments were replicated four times at factorial experiment in a RCBD. The number of trees used was 48 trees. The following parameters were determined in the two successive seasons:

1- Leaves number.

2- Stem diameter increase (mm): Stem diameter was measured using a (Vernier) at the beginning and end of the experiment, and calculating the difference between them for both seasons

3- Average of shoots length (cm): four branches were measured using metric tape from each experimental unit at the beginning and end of the experiment and calculating the difference between them for both seasons

4- Leaf chlorophyll contents (SPAD unit).

5- Leaf dry weight (%): Various leaves were taken from the trees was weighing then drained and calculated the percentage of dry matter by dividing weight after drying on weight before drying× 100

6- Leaf carbohydrates content (%): was determined according to Dubois *et.al*, (11).

7- Leaves mineral content: Leaves samples were collected for chemical analysis at the 2nd week of June. Each sample consisted of 10 leaves. Tree^{-1}. Leaves were washed with tap water, rinsed with distilled water, and then dried at 70 c^0 until a constant weight, ground and digested according (Chapman, and Pratt, 1978). Nitrogen was estimated by micro-kjeldahl method of (1). Phosphorus was estimated using a spectrophotometer by Estefan *et.al*, (12). Potassium was determined using Flame photometer according to (12).

8- Leaves hormonal content (IAA, gibberellins and zeatin) were assayed according to Ŭnyayar *et al.*, (23).

The obtained results were subjected to analysis of variance according to Elsahookie and Wuhaib (12) using L.S.D 0.05 for comparing differences between various treatment means.

RESULTS AND DISCUSSIONS

Effects of biofertilizers and poultry manure on leaves number, stem diameter increase and shoots length: Data concerning the effect of treatments on leaves number, stem diameter increase and shoots length during the two experimental seasons are listed in (Table -1). Data indicated that, *Azospirillum brasilense* + *Bacillus megatherium* (B_4) treatment significantly increased leaves number of 72.42 and 77.83 leaf.plant^{-1}, stem diameter increase of 12.49 and 13.38 mm and shoots length of 15.50 and 17.42 cm for both seasons, respectively. Table (1) also revealed that the poultry manure at level 500g.tree^{-1} (M_{500}) gave the highest leaves number of 74.61 and 80.06 leaf.plant^{-1}, stem diameter increase of 12.36 and 13.46 mm and shoot length of 15.15 and 17.30 cm for both seasons, respectively. Interaction treatment (B_4M_{500}) significantly affected in all studied traits in (Table -1).

Table 1. Effects of biofertilizers and poultry manure on leaves number, increased of stem diameter and shoots length of hawthorn transplants during 2017 and 2018 seasons

season	2017				2018			
Biofertilizers	Poultry manure (M)				Poultry manure (M)			
	0	250	500	mean	0	250	500	mean
Leaves number								
B_1	64.50	66.50	70.00	67.00	66.75	70.75	74.25	70.58
B_2	66.00	72.25	76.75	71.67	69.00	79.50	81.75	76.75
B_3	67.25	68.75	74.00	70.00	67.25	76.00	80.75	74.67
B_4	67.75	71.75	77.75	72.42	70.50	80.00	83.50	77.83
mean	66.38	69.81	74.61		68.38	76.56	80.06	
LSD 0.05	M	B	M×B		M	B	M×B	
	1.81	2.09	3.62		2.04	2.36	4.08	
Stem diameter (mm)								
B_1	10.22	10.96	11.43	10.87	11.78	11.86	12.00	11.88
B_2	10.90	11.75	11.92	11.52	11.96	12.11	12.73	12.27
B_3	11.36	12.53	12.89	12.26	11.80	12.36	13.89	12.68
B_4	11.40	12.87	13.19	12.49	12.03	12.88	15.22	13.38
mean	10.97	12.03	12.36		11.89	12.30	13.46	
LSD 0.05	M	B	M×B		M	B	M×B	
	0.43	0.50	0.86		0.47	0.54	0.92	
Shoots length (cm)								
B_1	12.10	12.56	13.07	12.58	13.26	13.82	15.67	14.25
B_2	14.21	14.90	15.93	15.01	15.00	16.29	17.78	16.36
B_3	12.80	13.55	14.66	13.67	14.21	15.03	16.30	15.18
B_4	14.51	15.06	16.94	15.50	15.72	17.11	19.44	17.42
mean	13.41	14.02	15.15		14.55	15.56	17.30	
LSD 0.05	M	B	M×B		M	B	M×B	
	0.55	0.64	1.10		0.70	0.81	1.40	

Effects of biofertilizers and poultry manure on chlorophyll content, dry weight and carbohydrates content in leaves:

Results in (Table- 2) indicated that, *Azospirillum brasilense* + *Bacillus megatherium* (B_4) treatment significantly increased leaves chlorophyll content of 59.31 and 59.79 SPAD units and the highest leaves carbohydrates content of 9.68 and 10.48 % for both seasons, respectively. Leaves dry weight was not affected in the first year, while the same treatment (B_4) gave the highest leaves dry weight of 33.45 % for the second year. Table (2) also shows that the poultry manure at level 500g.tree^{-1} (M_{500}) was superior compared to control treatment and gave the highest leaves chlorophyll content of 59.19 and 59.96 SPAD units, leaves dry weight of 31.53 and 33.35 % and leaves carbohydrates content of 9.58 and 10.37 % for both seasons, respectively. Interactions treatment (B_4M_{500}) significantly had an effect on all studied traits in table (2).

Table 2. Effects of biofertilizers and poultry manure on chlorophyll content, dry weight and carbohydrates content in leaves of hawthorn transplants during 2017 and 2018 seasons

season	2017				2018			
Biofertilizers	Poultry manure (M)				Poultry manure (M)			
	0	250	500	mean	0	250	500	mean
Leaf chlorophyll content (SPAD units)								
B_1	53.37	55.18	56.92	55.16	53.91	55.70	57.48	55.70
B_2	57.11	58.29	60.03	58.48	56.82	58.58	60.62	58.67
B_3	53.48	56.00	58.48	55.99	54.94	57.11	59.54	57.20
B_4	57.67	58.92	61.34	59.31	57.95	59.22	62.20	59.79
mean	55.41	57.10	59.19		55.91	57.65	59.96	
LSD 0.05	M	B	M×B		M	B	M×B	
	1.38	1.59	2.76		1.52	1.76	3.04	
Leaves dry weight (%)								
B_1	30.14	32.01	31.18	31.11	31.23	31.80	32.54	31.86
B_2	31.58	31.13	30.87	31.19	32.29	32.86	33.76	32.97
B_3	30.38	31.19	31.81	31.13	31.98	32.08	32.96	32.34
B_4	31.38	30.17	32.24	31.26	32.77	33.45	34.14	33.45
mean	30.87	31.13	31.53		32.07	32.55	33.35	
LSD 0.05	M	B	M×B		M	B	M×B	
	0.18	N.S	0.35		0.32	0.37	0.64	
Leaves carbohydrates content (%)								
B_1	8.38	8.93	8.85	8.72	8.44	9.02	9.44	8.97
B_2	9.14	9.49	9.83	9.49	9.52	10.13	10.86	10.17
B_3	8.56	9.02	9.44	9.01	8.94	9.67	10.04	9.55
B_4	9.19	9.66	10.20	9.68	9.92	10.38	11.14	10.48
mean	8.82	9.28	9.58		9.21	9.80	10.37	
LSD 0.05	M	B	M×B		M	B	M×B	
	0.24	0.28	0.48		0.36	0.42	0.71	

These results are attributed to the role of biofertilizers in improving soil biological and physical properties as well as the chemical properties resulting from the release of larger quantities of nutrients available for absorption by the roots and thus influence the physiological processes such as increasing the efficiency of photosynthesis in the leaves (24) and increase its output such as carbohydrates and thus increase vegetative growth. Also may be due to increase the microbial potential of biofertilizers and organic manure to produce plant growth regulators such as auxin, cytokines and gibberellins (Tables 4), which affect growth and increase uptake of soil nutrients (21). Generally, these results are in harmony with those reported by (17) on pear trees and (3) on apricot trees.

Effects of biofertilizers and poultry manure on leaves N, P, K content:

Data concerning the effect of treatments on leaves nitrogen, phosphor and potassium content are listed in Table (3). The data cleared that *Azospirillum brasilense* + *Bacillus megatherium* (B_4) treatment significantly increased and gave the highest leaf nitrogen and phosphor content, while biofertilizers treatments did not affect on leaf potassium content. Table (3) also shows that the poultry manure at level 500g.tree^{-1} (M_{500}) significantly superiority of the control treatment and gave the highest leaf nitrogen and phosphor content. The interaction between biofertilizers and poultry manure treatments significantly affected especially at *Azospirillum brasilense* + *Bacillus megatherium* and poultry manure at level 500g.tree^{-1} (B_4M_{500}) as it gave the highest leaf nitrogen content of 1.83 and1.96 % and leaf phosphor content of 0.41 and 0.48 %, for both seasons respectively . Values in Table (3) showed that leaf potassium content was not affected by biofertilizers and poultry manure treatments.

Effects of biofertilizers and poultry manure on leaves IAA, GA_3 and Zeatin content:

Data concerning the effect of treatments on leaves IAA, GA and zeatin content are listed in Table (4). The data cleared that *Azospirillum brasilense* + *Bacillus megatherium* (B_4) treatment gave the, highest leaf IAA content of 34.41 and 38.85 μg g^{-1} FW and highest leaf GA content of 133.22 and 135.86 μg g^{-1} FW and highest leaf zeatin content of 35.87 and 36.96 μg g^{-1} FW, for both seasons respectively. Table (4) also shows that poultry manure at levels 500g.tree^{-1} (M_{500}) gave the highest leaf IAA content of 34.57 and 38.49 μg g^{-1} FW and highest leaf GA content of 139.46 and μg g^{-1} FW and highest leaf zeatin content of 35.99 and 36.63 μg g^{-1} FW, for both seasons respectively. The interaction between biofertilizers and poultry manure significantly affected all studied parameters. The reason for these results is that the addition of bio and organic fertilizer to the soil has led to a greater concentration of these elements in the soil solution increasing its availability and thus increasing their transmission and thus increase the concentration of these elements in the leaves. It is also due to the increase leaves number and leaves chlorophyll content (Tables 1 and 2) resulting in the absorption of these elements to meet their vegetative needs (5). Also increase leaves mineral and hormonal content by adding organic fertilizer, especially poultry manure may be due to increased concentration in poultry manure and thus increases its concentration in leaves (20). These results are in harmony with those obtained by (4) who worked on biofertilizers in apricot and peach trees, (20) are found that the application of organic fertilizer gave the highest leaves mineral content, (9) who worked on organic fertilizers in peach trees.

Table 3. Effects of biofertilizers and poultry manure on leaves N,P,K content of hawthorn transplants during 2017 and 2018 seasons

season	2017				2018			
Biofertilizers	Poultry manure (M)				Poultry manure (M)			
	0	250	500	mean	0	250	500	mean
				N (%)				
B_1	1.22	1.36	1.55	1.38	1.27	1.39	1.72	1.46
B_2	1.37	1.51	1.70	1.53	1.43	1.66	1.84	1.64
B_3	1.30	1.41	1.49	1.40	1.38	1.53	1.77	1.56
B_4	1.44	1.59	1.83	1.62	1.55	1.74	1.96	1.75
mean	1.33	1.47	1.64		1.41	1.58	1.82	
LSD 0.05	M	B	M×B		M	B	M×B	
	0.11	0.13	0.22		0.13	0.15	0.26	
				P (%)				
B_1	0.18	0.20	0.21	0.20	0.20	0.22	0.28	0.23
B_2	0.21	0.24	0.29	0.25	0.24	0.31	0.33	0.29
B_3	0.23	0.31	0.40	0.31	0.29	0.41	0.46	0.39
B_4	0.24	0.33	0.41	0.33	0.30	0.41	0.48	0.40
mean	0.22	0.27	0.33		0.26	0.34	0.39	
LSD 0.05	M	B	M×B		M	B	M×B	
	0.06	0.07	0.12		0.05	0.06	0.10	
				K (%)				
B_1	1.19	1.31	1.25	1.25	1.33	1.47	1.41	1.40
B_2	1.23	1.29	1.25	1.26	1.40	1.45	1.37	1.41
B_3	1.22	1.20	1.33	1.25	1.28	1.39	1.51	1.39
B_4	1.26	1.21	1.28	1.25	1.49	1.32	1.40	1.40
mean	1.23	1.25	1.28		1.38	1.41	1.42	
LSD 0.05	M	B	M×B		M	B	M×B	
	N.S	N.S	N.S		N.S	N.S	N.S	

Table 4. Effects of biofertilizers and poultry manure on leaves IAA, GA and Zeatin content of hawthorn transplants during 2017 and 2018 seasons

season	2017				2018			
Biofertilizers	Poultry manure (M)				Poultry manure (M)			
	0	250	500	mean	0	250	500	mean
				Leaves IAA content (μg g^{-1} FW)				
B_1	30.48	30.96	32.04	31.16	31.33	32.76	36.04	33.38
B_2	31.18	33.15	35.48	33.27	33.51	35.97	39.06	36.18
B_3	30.82	32.08	33.90	32.27	33.12	34.48	37.38	34.99
B_4	32.56	33.80	36.86	34.41	36.16	38.92	41.48	38.85
mean	31.26	32.50	34.57		33.53	35.53	38.49	
LSD 0.05	M	B	M×B		M	B	M×B	
	1.13	1.30	2.26		1.69	1.95	3.38	
				Leaves GA content (μg g^{-1} FW)				
B_1	102.70	109.86	121.19	111.25	107.27	112.82	126.22	115.26
B_2	108.88	117.26	150.65	125.60	118.18	120.28	148.89	129.12
B_3	105.67	112.42	133.36	117.15	116.28	126.20	137.39	126.62
B_4	115.16	131.78	152.72	133.22	121.32	135.70	150.55	135.86
mean	108.10	117.83	139.46		115.76	123.75	140.76	
LSD 0.05	M	B	M×B		M	B	M×B	
	7.18	8.29	14.35		6.42	7.41	12.84	
				Leaves Zeatin content (μg g^{-1} FW)				
B_1	32.81	33.32	33.94	33.36	32.42	33.08	34.22	33.24
B_2	33.68	34.52	36.84	35.01	33.80	35.12	37.12	35.35
B_3	33.20	33.90	35.08	34.06	32.96	33.62	35.98	34.19
B_4	33.90	35.60	38.11	35.87	34.43	37.28	39.18	36.96
mean	33.40	34.34	35.99		33.40	34.78	36.63	
LSD 0.05	M	B	M×B		M	B	M×B	
	0.74	0.85	1.48		0.69	0.80	1.38	

REFERENCES

1. A.O.A.C. 1980. Official Methods of Analysis. 13th. Ed. Association of Official Analytical Chemists. Washington, D.C

2. Abo AL-Mikh, M.T. 2017. Influence of bio-fertilizer and spraying with the plant extracts on some growth indicators and leaves content of nutrient in *Punica grantum* (wonderful). Kufa Journal of Agricultural Sciences. 9(3):42-59.

3. Al-Hadethi, Mustafa. E.A. 2015. Effect of Different Fertilization Sources and the Growth Regulator (Brassinosteroids) on Growth and Yield of Apricot Trees. Ph.D. Dissertation, Coll. of Agric., Univ. of Baghdad. pp. 153

4. Al-Hadethi, Mustafa E.A; Ali S.T. AL-Dulaimi and B.M.K. Almashhadani. 2017. Influence of biofertilizers on growth and leaf mineral content in Peach transplants. IOSR Journal of Agriculture and Veterinary Science. 10(9):90-93.

5. Ali, N.S. 2012. Fertilizer Technology and Uses. Ministry of Higher Education and Research. Univ. Baghdad. pp. 202

6. Ali, N.S and A.A, Shakir.2018. Organic Fertilization and its Role in Sustainable Agriculture. Dar al-Kutb for Printing and Publishing. Baghdad. Iraq. pp.216.
7. AL Maa'thidy, A.M; Saleem I. Shahbaz and Z. A, Dousky. 2007. Numerical taxonomy for genus Crataegus L. (Rosaceae) in north of Iraq. Rafidain Journal of Science**.** 18(1):1-15
8. Al-Obaidi, A.S.H. 2008. Response of Apricot Trees *Prunus armeniaca* L.c.v. Zaini to Organic and Mineral Fertilization. M.Sc. Thesis, Coll. of Agaric. University of Baghdad., Iraq.pp. 122.
9. Al-Rawi, W. A. A., M. E.A. Al-Hadethi and A. A. Abdul-Kareem. 2016. Effect of foliar application of gibberellic acid and seaweed extract spray on growth and leaf mineral content on peach trees. The Iraqi Journal of Agricultural Sciences. 47 (Special Issue): 98-105.
10. Chapman, H,D. and P. E, Pratt. 1978. Methods of Analysis for Soils, Plants, and Waters. Univ. of Calif., Div. Agric. Sci., Priced Pub., 4034.pp. 150
11. Dubois, M., K, Gilles., J, Hamilton ., P, Rebers and F, Smith. 1956. Colorimetric method for determination of sugars and related substances. Analytical Chemistry, 28(3):350–356
12. Elsahookie,M.M and K.M. Wuhaib. 1990. Design and Analysis of Experiments. Univ. of Bagh. Dar al hekma.pp.488
13. Estefan, G; R.Sommer and J.Ryan .2013. Methods of soil, plants and water analysis, ICARDA, International for Agriculture Research in the dry areas, third edition. www.icarda.org
14. Hamad, R.M and I, Abd, Ghahth. 2013. Effect of organic fertilizers on some of the qualities of shoot and root growth for pomegranate seedlings (*Punica granatum* L.). Al- Anbar Journal of Agricultural Sciences. 11(2):1-15
15. Kakehzadeh, S; S, Sharafzadeh and Bahram Amiri. 2014. Vegetative growth of apple tree as affected by irrigation frequency and chicken manure rate. International Journal of Biosciences. 4(2):120-124
16. Mahdi, S.S, G. I. Hassan, S. A. Samoon, H. A. Rather, Showkat A. Dar and B. Zehra. 2010. Bio-fertilizers in organic agriculture. Journal of Phytology. 2(10): 42-54
17. Mohammed ,S.M , T.A, Fayed , A.F, Esmail and N.A,Abdou.2010. Growth, nutrient status and yield of Le-Conte pear trees as influenced by organic and biofertilizer rates compared with chemical fertilizer. Bull. Fac .Agric .Cairo Univ. 61(1):17-32
18. Nabavi, S.F; S, Habtemariam; T, Ahmed; A, Sureda; M, Daglia; E. S, Sánchez and S. M, Nabavi. 2015. Polyphenolic Composition of *Crataegus monogyna* Jacq.: From Chemistry to medical applications. Nutrients. 7:7708-7728.
19. Nithya, D, S.M. Poornima, R.Pazhani murugan, V.Gopikrishnan, M.Radhakrishnan, D, Bhivi and R.Balagurunathan. 2011. Influence of biofertilizers and irrigation systems for the growth and yield of mulberry plants. International Journal of Plant, Animal and Environmental Sciences. 1(3):93-99
20. Obaid, E.A. 2012. Effect of foliar application of potassium and organic manure on the growth and yield of Labeeb apricot cultivar (*Prunus armeniaca* L.). Egypt.J. of Appl.Sci. 27(4):162-172
21. Soliman, M.G.A. 2001.Response of Banana and Guava Plants to some Biological and Mineral Fertilizers. M. Sc. Thesis. Fac. Agric. Alex. Univ. Egypt.pp.61.
22. Tassell, M.C; R, Kingston; D, Gilory; M, Lehane and A, Furey. 2010. Hawthorn (*Crataegus* spp.) in the treatment of cardiovascular disease. Pharmacogn Rev.4(7):32-41.
23. Ŭnyayar, S.; S.F, Topcuoğlu and A, Ŭnyayar. 1996. A modified method for extraction and identification of indole-3-acetic acid (IAA), gibberellic acid (GA3), Abscisic acid (ABA) and zeatine produced Phanoerochate chrysosporium ME446. bulg. J. Plant Physiol., 22 (3-4): 105-110
24. Yu, Xuan; Xu Liu and Tian-hui Zhu. 2014. Walnut growth and soil quality after inoculating soil containing rock phosphate with phosphate-solubilizing bacteria. Science Asia. 40(1): 21-27.