EFFECT OF NITROGEN, ROOT STIMULATOR, AND GIBBERELLIC ACID ON A SPECIFIC CHARACTERISTICS OF PEACH SAPLINGS

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ABSTRACT

This study was aimed to evaluate the effect of nitrogen fertilizer, organic root stimulator and gibberellic acid on some growth characters of peach saplings cv. Red June for two consecutive seasons 2017-2018 at College of Agricultural Engineering Science, University of Baghdad. Different nitrogen (Urea 46%N) rates (0,50,75 gm) with three concentrations of organic stimulator (0,0.5,1 gm.L^{-1}) and two rates of Ga3 (0,50 mg.L^{-1}) were applied in a factorial scheme (3×3×2). Results revealed that the individual and interactive effect of applying nitrogen, root stimulator and GA3 significantly increased the studied characters, the interaction at N2D1G1 has improved the leaf dry weight (42.00%), shoot dry weight (61.33 %), Relative water content (RWC) (60.00%), N (2.68%), P (0.414%) and K (1.94 %) for season 2017, while the treatment N2D2G1 had the highest values at leaf dry weight (46.00 %), shoot dry weight (64.00%), RWC (74.00%) and leaf content of N (2.39%), P (0.56%), and K (1.99%) for season 2018.

Key words: mineral nutrition, organic fertilizers, GA3, fruit trees
***Part of M.Sc. thesis of the 1st author.**

تأثير اضافة النتروجين ومحفز الجذور ورش حامض الجبرليك في بعض صفات النمو لشتلات الخوخ

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المستخلص

نفذ البحث في بستان الفاكهة الواقع في كلية علوم الهندسة الزراعية – جامعة بغداد خلال موسمي النمو 2017–2018 بهدف دراسة تأثير اضافة النيتروجين ومحفز الجذور والرش الورقي لحامض الجبرليك في بعض صفات النمو لشتلات الخوخ , نفذت تجربة عاملية بثلاثة عوامل وفق تصميم RCBD, تم اضافة سماد اليوريا بالتراكيز (0 و50 و75 غم شتلة) والمحفز الجذري بالتراكيز (0 و0.5 و1 غم لتر$^{-1}$) وحامض الجبرليك بالتراكيز (0 و50 ملغم لتر$^{-1}$) , اظهرت النتائج وجود فروقاً معنوية لعوامل الدراسة المنفردة حيث تفوق النيتروجين عند التركيز 75غم شتلة في معظم الصفات المقاسة للموسمين, وتفوق المحفز الجذري عند التركيز 0.5 غم لتر في الموسم الاول بينما تفوق التركيز 1 غم لتر في الموسم الثاني, كذلك اثر حامض الجبرليك معنوياً في معظم الصفات, اما التداخل الثلاثي فقد اعطت المعاملة N2D1G1 للموسم الاول اعلى فروقاً معنوية في الوزن الجاف للافرع (42.00%) والافرع (61.33 %) ومحتوى الماء النسبي (60.00 %) ومحتوى الاوراق من عناصر النيتروجين (2.68 %) والفسفور (0.41 %) والبوتاسيوم (1.94 %) بينما تفوقت المعاملة D2N2G1 في الموسم الثاني في الصفات المدروسة اذ بلغ الوزن الجاف للاوراق (46.00 %) وللافرع (64.00 %) ومحتوى الماء النسبي (74.00 %) ومحتوى الاوراق من النيتروجين (2.39 %) و الفسفور (0.56 %) والبوتاسيوم (1.99 %).

الكلمات المفتاحية: التغذية المعدنية، السماد العضوي، منظمات النمو، اشجار فاكهة
***البحث مستل من رسالة ماجستير للباحث الاول**

***Received:21/9/2018, Accepted:30/12/2018**

INTRODUCTION

Peach (*Prunus persica* L.) is revered as a delicious and healthy summer fruit in most temperate climate regions of the world. It's a major fruit crop of commerce in China, Italy, Spain, USA, and Greece the top five producing countries, respectively. Currently there are nearly 1.5 Million ha of peach trees in production worldwide with the vast majority produced in China (Approx. 46%) (16). Nitrogen is a nutrient required in great quantities by Peach trees, It has a direct effect on vegetative growth, yield, and fruit quality; therefore the setting of dose is necessary to ensure the best nutritional balance (8). Abdel-sattar and Mohammed (1) Mentioned that nitrogen application on pomegranate has a significant effect on leaf dry weight and N, P, and K leaf content, Thokchom *et al*. (20) found that applying nitrogen fertilizers on Apricot trees cv. New Castle significantly increased N leaf content, Liu et al (9) recorded that the Application of Nitrogen with two different irrigation regimes increased relative water content (RWC). In recent reports the application of organic fertilizers improved mineral fertilizers affect on soil fertility and enhanced vegetative growth and fruit production (21). Hidayatullah *et al* (15) mentioned that the application of Humic acid on apple trees cv. Red delicious enhanced the N, P, and K leaf content of and branch numbers, Al- ahbaby (2) found that the application of sea weed extract on grapes enhanced leaf dry weight and N, P, K leaf content. GAs are tetracyclic diterpenoid compounds stimulating seed germination, juvenility, cells division and enlargement (19). Al-rashdi *et al*(6) recorded that foliar application of Ga3 on grape increased the N, P, K leaf content, Al-rawi *et al*(7) found that Ga3 spray on peach trees Cv. Peento enhanced the leaf dry weight and leaf content of N, P, and K. All given above, this study was aimed to evaluate the effect of nitrogen, root stimulator and Gibberellic acid on vegetative growth of peach saplings CV. Red June**.**

MATERIALS AND METHODS

The Present study was performed on "Red June" peach trees, all of which were almost uniformed in vigor, grown under conventionally accepted practices. A factorial experiment randomized complete block design (RCBD) with 5 replicates was conducted on 90 trees planted over 5 rows with 3.5 meters between each row, occupied with 18 trees per row, spaced by 2.5 meters at the College of Agricultural Engineering Sciences, University of Baghdad peach orchard for two consecutive seasons 2017-2018. In this experiment different concentrations of Nitrogen (0,50,75 gm $tree^{-1}$), organic stimulator (0,0.5,1 mg L^{-1}) and two rates of GA3 (0,50 ppm), were applied in April, then repeated three times (beginning of April, May, and June) except for disper root which started in the middle of March and repeated bi-weekly until June. Shoot dry weight, leaf dry weight were found using the formula (dry weight\wet weight)×100, while N were measured according to Haynes(13) method, and P according to Olsen and Sommers (18), also K leaf content were found using Haynes (13) method, and relative water content (RWC) according to Wu *et al* (22). All parameters were measured and subjected to computerized statistical analysis of variance (ANOVA) and means of treatments were compared using L.S.D at 0.05 .

RESULTS AND DISCUSSIONS

Leaf dry weight (%)

Results in table(1) shows that the application of Nitrogen at 75 gm gave the highest value in both growth seasons (38.17 , 40.89) respectively , as well as the Root stimulator at 0.5 $gm.L^{-1}$ gave a significant value for season 2017 reached (37.06 %) while the concentration 1 $gm.L^{-1}$ gave (41.89 %) in season 2018, also GA3 gave significant values (34.41 , 39.15 %) for the consecutive seasonal growth. The tripartite interaction showed the highest value in season 2017 at N2D1G1 reached (42.00 %) while the treatment N2D2G1 produced the highest value for season 2018 reached (46.00 %), Nitrogen's effect on construction of chlorophyll pigment which is important in the process of photosynthesis, increases the proportion of processed nutrients and their accumulation in plant tissues causing an increase in dry weight(8), The effect of root stimulator on dry weight may be due to the increase in leaf area and chlorophyll content relatively increasing manufactured materials which accumulated in

branches and leaves(11), or could be due to the effect of GA3 increasing root growth, leaf area and leaf dry weight (19). These results are in agreement with (4) and (7) on peach and (15) on apricot.

Shoot dry weight (%)

Based on the results in Table 2 the concentration 75 gm has the highest outcome peaked at (50.00, 56.17) for both seasons respectively, and the application of root stimulator at 0.5 gm.L^{-1} had a most significant rate (50.22 %) in season 2017 while the concentration 1 gm.L^{-1} granted the highest outcome in season 2018 (51.33 %). Meanwhile the foliar application of GA3 gave a significant value in both growth seasons peaked at (46.89, 53.48 %) respectively. The interaction treatment N2D1G1 granted the most significant value (61.33 %) in season 2017 while the treatment N2D2G1 gave the highest value in season 2018 peaked at (64.00 %). The Nitrogen effect in construction of chlorophyll pigment which is important in the process of photosynthesis, increases the proportion of processed nutrients and their accumulation in plant tissues causing an increase in dry weight(8), The effect of root stimulator on dry weight may be due the effect of amino acids in enzyme activity which effects on accelerating the absorption and transmission of nutrients within the plant and then increase the process of photosynthesis which leads to accumulation of numerous nutrients in plant tissues and increase the dry weight(10).

Relative water content (RWC) (%)

Data in Table 3 shows that the application of Nitrogen at 75 gm produced the highest rate in both seasons (53.11, 60.78 %) respectively, While the application of root stimulator at 0.5 gm.L^{-1} had the highest value in season 2017 reached (55.50 %) while the concentration 1 gm.L^{-1} had the most significant outcome (66.61 %) in season 2018, as well as the GA3 in both growth seasons had a significant rate of RWC peaked at (51.78, 57.85 %) respectively, the interaction N2D1G1 had the highest value in season 2017 peaked at (60.00 %) while the treatment N2D2G1 gave a significant rate in 2018 reaching (74.00 %), The individual or interactive effect of nitrogen, root stimulator and Gibberellic acid can be due to their role in increasing root growth and positively increasing water absorption, which increases relative water content in the leaves(12) (8)(19), these results agreed with (9).

Leaf Nitrogen content(%)

Results from Table 4 shows that the application of Urea at 75 gm gave significant rate peaked at (2.19, 1.85 %) for both seasons, The soil application of root stimulator at 0.5 gm.L^{-1} gave the highest value (1.99 %) in season 2017 while the concentration 1 gm.L^{-1} had the highest value in season 2018 peaked at (1.90 %), meanwhile the foliar application of GA3 produced a significant values peaked at (1.87, 1.60 %) in both growth seasons respectively, meanwhile the interaction at N2D1G1 gave the highest value in season 2017 reaching (2.68 %) while the treatment N2D2G1 had the highest rate in season 2018 peaked at (2.39 %). The increased concentration of Nitrogen in leaves might be due to the direct application of Urea or might be due to the role of root stimulator on root nutrient availability, which leads to increase nutrients absorption and accumulation in leaves(11) These results are in agreement with the results of other researchers (5) and (7) on peach and (3) on apple and (1) on Pomegranate.

Phosphorus Leaf content(%)

Results in Table 5 shows that the nitrogen fertilizer at 75 gm had the most significant value in season 2017 and 2018 peaked at (0.35, 0.44 %) respectively, also the application of root stimulator at 0.5 gm.L^{-1} gave the highest rate in season 2017 reached (0.34 %) while the concentration 1 gm.L^{-1} recorded the most significant value (0.47 %) in season 2018, Foliar application of GA3 gave significant values in both seasons 2017 and 2018 peaked at (0.32, 0.40 %). The interaction N2D1G1 recorded the highest value in season 2017 peaked at (0.41 %) while the treatment N2D2G1 granted the most significant value in season 2018 reaching (0.56 %). The effect of Nitrogen may be due to its role in cells division and vegetative and root system growth which positively increases the absorption efficiency of soil nutrients and increase leaf P concentrations (8), or it may be due to the role of Humic acid in root

nutrient availability, leading to an increase in nutrients absorption and accumulation in leaves(11), or it may be due to the effect of Gibberellic acid in increasing the nutrients in leaves or may be due to its role in activating cell division and elongation and increasing the absorption of nutrients from the roots(19), these results are in agreement with the results of other researches (1) on Pomegranate and (7) on Peach and (14) on apple.

Leaf Potassium content(%)

Results in Table 6 shows that the application of Nitrogen at 75 gm had the highest value peaked at (1.79, 1.78 %) in both seasons sequentially, the Root stimulator at 0.5 gm.L^{-1} gave the highest value (1.70 %) in season 2017 while the concentration 1 gm.L^{-1} granted (1.78 %) in season 2018, also the foliar spray of GA3 granted the highest rates in both growth seasons reached (1.64, 1.63 %) respectively , the interaction N2D1G1 gave a significant value peaked at (1.91 %) in season 2017 while the interaction N2D2G1 gave the highest outcome (1.99 %) in season 2018. The interaction treatment N2D1G1 granted the highest rate in season 2017 peaked at (1.94 %) while the treatment N2D2G1 gave a significant value in season 2018 (1.99 %). The effect of Nitrogen may be due to its role in cells division and vegetative and root system growth which positively increases the absorption efficiency of soil nutrients and increasing the leaf K concentrations (8).or it may be due to the role of Humic acid in root nutrient availability, leading to increase nutrient absorption and accumulates in the leaves(11),or it may be due to the effect of Gebberellic acid in increasing the nutrients in the leaves may be due to its role in activating the division and elongation of cells and increase the absorption of nutrients from the roots(19), these results are in agreement with the results of other researchers (1) on pomegranate and (7) on peach and (14) on apple.

Table1. Effect of nitrogen, root stimulator and foliar application of GA3 on Leaf dry weight (%).

D	N	2017			2018		
		G		D*N			D*N
		0	50		0	50	
0	0	25.00	28.00	26.50	29.33	30.67	30.00
	50	30.00	33.00	31.50	33.00	35.00	34.00
	75	34.00	39.00	36.50	36.00	39.00	37.50
0.5	0	32.00	34.00	33.00	34.00	37.33	35.67
	50	36.00	39.00	37.50	36.00	39.99	37.67
	75	39.33	42.00	40.67	39.00	42.00	40.50
1	0	28.00	31.00	29.50	38.00	40.00	39.00
	50	30.67	33.00	31.83	41.00	43.00	42.00
	75	35.00	39.67	37.33	43.33	46.00	44.67
Lsd			2.46	1.74		2.28	1.61
				D			D
G*D	0	29.67	33.33	31.50	32.78	34.89	33.83
	0.5	35.78	38.33	37.06	36.33	39.56	37.94
	1	31.22	34.56	32.89	40.78	43.00	41.89
Lsd			1.42	1.00		1.32	0.93
				N			N
G*N	0	28.33	31.00	29.67	33.78	36.00	34.89
	50	32.22	35.00	33.61	36.67	39.11	37.89
	75	36.11	40.22	38.17	39.44	42.33	40.89
Lsd			1.42	1.00		1.32	0.93
G		32.22	35.41		36.63	39.15	
Lsd			0.82			0.76	

Table2. Effect of nitrogen, root stimulator and foliar application of GA3 on shoot dry weight (%)

D	N	2017			2018		
		G		D*N			D*N
		0	50		0	50	
0	0	35.00	38.00	36.50	38.00	43.00	40.50
	50	38.33	40.67	39.50	43.33	47.00	45.17
	75	41.67	46.00	43.83	47.33	52.00	49.67
0.5	0	43.00	46.00	44.50	44.00	48.00	46.00
	50	47.33	52.33	49.83	49.00	54.00	51.50
	75	51.33	61.33	56.33	53.00	60.00	56.50
1	0	39.67	40.33	40.00	50.00	53.00	51.50
	50	41.00	44.00	42.50	54.33	60.33	57.33
	75	46.33	53.33	49.83	60.67	64.00	62.33
	Lsd		3.525	2.492		4.09	2.92
				D			D
G*D	0	38.33	41.56	39.94	42.89	47.33	45.11
	0.5	47.22	53.22	50.22	48.67	54.00	51.33
	1	42.33	45.89	44.11	55.00	59.11	57.06
	Lsd		2.035	1.439		2.34	1.66
				N			N
G*N	0	39.22	41.44	40.33	44.00	48.00	46.00
	50	42.22	45.67	43.94	48.89	53.78	51.33
	75	46.44	53.56	50.00	53.67	58.67	56.17
	Lsd		2.035	1.439		2.34	1.66
	G	42.63	46.89		48.85	53.48	
	Lsd		1.175			1.35	

Table3. Effect of nitrogen, root stimulator and foliar application of GA3 on Relative water content (RWC) (%)

D	N	2017			2018		
		G		D*N			D*N
		0	50		0	50	
0	0	40.00	44.33	42.17	45.33	48.33	46.83
	50	45.00	49.00	47.00	50.33	54.00	52.17
	75	48.67	50.33	49.50	53.00	55.33	54.17
0.5	0	50.00	54.00	52.00	46.00	49.00	47.50
	50	54.00	58.00	56.00	50.33	53.00	51.67
	75	57.00	60.00	58.50	54.00	58.00	56.00
1	0	44.00	47.00	45.50	60.33	60.00	60.17
	50	48.33	50.00	49.17	66.00	69.00	67.50
	75	49.33	53.33	51.33	70.33	74.00	72.17
	Lsd		3.50	2.48		5.642	3.989
				D			D
G*D	0	44.56	47.89	46.22	49.56	52.56	51.06
	0.5	53.67	57.33	55.50	50.11	53.33	51.72
	1	47.22	50.11	48.67	65.56	67.67	66.61
	Lsd		3.50	1.43		3.257	2.303
				N			N
G*N	0	44.67	48.44	46.56	50.56	52.44	51.50
	50	49.11	52.33	50.72	55.56	58.67	57.11
	75	51.67	54.56	53.11	59.11	62.44	60.78
	Lsd		2.02	1.43		3.257	2.303
	G	48.48	51.78		55.07	57.85	
	Lsd		1.17			1.881	

Table4. Effect of nitrogen, root stimulator and foliar application of GA3 on leaf Nitrogen content (%)

D	N	2017			2018		
		G		D*N			D*N
		0	50		0	50	
0	0	0.82	1.02	0.92	0.90	0.99	0.95
	50	1.64	1.74	1.69	1.20	1.28	1.24
	75	1.94	2.06	2.00	1.33	1.41	1.37
0.5	0	1.36	1.62	1.49	1.20	1.39	1.29
	50	1.98	2.14	2.06	1.44	1.55	1.49
	75	2.18	2.68	2.43	1.79	1.89	1.84
1	0	1.22	1.44	1.33	1.46	1.59	1.52
	50	1.76	1.98	1.87	1.79	1.90	1.84
	75	2.08	2.20	2.14	2.27	2.39	2.33
	Lsd		0.20	0.14		0.08	0.06
				D			D
G*D	0	1.46	1.60	1.53	1.14	1.23	1.18
	0.5	1.84	2.14	1.99	1.47	1.61	1.54
	1	1.68	1.87	1.78	1.84	1.96	1.90
	Lsd		0.11	0.08		0.05	0.03
				N			N
G*N	0	1.13	1.36	1.24	1.19	1.32	1.25
	50	1.79	1.95	1.87	1.47	1.58	1.52
	75	2.06	2.31	2.19	1.80	1.90	1.85
	Lsd		0.11	0.08		0.05	0.03
	G	1.66	1.87		1.48	1.60	
	Lsd		0.06			0.02	

Table5. Effect of nitrogen, root stimulator and foliar application of GA3 on leaf Phosphorus content (%)

D	N	2017			2018		
		G		D*N			D*N
		0	50		0	50	
0	0	0.202	0.216	0.209	0.20	0.26	0.23
	50	0.272	0.294	0.284	0.28	0.31	0.29
	75	0.294	0.322	0.308	0.34	0.38	0.36
0.5	0	0.294	0.320	0.307	0.28	0.33	0.30
	50	0.342	0.342	0.343	0.35	0.40	0.37
	75	0.372	0.414	0.393	0.42	0.47	0.44
1	0	0.250	0.266	0.258	0.36	0.40	0.38
	50	0.294	0.310	0.305	0.48	0.50	0.49
	75	0.350	0.394	0.372	0.51	0.56	0.53
	Lsd		0.023	0.016		0.036	0.02
				D			D
G*D	0	0.256	0.378	0.267	0.27	0.31	0.29
	0.5	0.336	0.359	0.347	0.35	0.40	0.37
	1	0.350	0.325	0.311	0.45	0.49	0.47
	Lsd		0.013	0.009		0.02	0.014
				N			N
G*N	0	0.248	0.267	0.258	0.28	0.33	0.30
	50	0.302	0.318	0.310	0.37	0.40	0.38
	75	0.338	0.376	0.357	0.42	0.47	0.44
	Lsd		0.013	0.009		0.02	0.014
	G	0.296	0.320		0.35	0.40	
	Lsd		0.007			0.012	

Table6. Effect of nitrogen, root stimulator and foliar application of GA3 on leaf Potassium content (%)

D	N	2017			2018		
		G		D*N			D*N
		0	50		0	50	
0	0	1.14	1.38	1.26	1.18	1.25	1.21
	50	1.48	1.58	1.53	1.28	1.38	1.33
	75	1.68	1.76	1.72	1.48	1.60	1.54
0.5	0	1.46	1.56	1.51	1.28	1.36	1.32
	50	1.66	1.74	1.70	1.42	1.69	1.55
	75	1.88	1.94	1.91	1.82	1.93	1.87
1	0	1.34	1.46	1.40	1.51	1.66	1.58
	50	1.58	1.60	1.59	1.79	1.88	1.83
	75	1.74	1.78	1.76	1.90	1.99	1.94
	Lsd		1.162	0.115		0.028	0.020
				D			D
G*D	0	1.43	1.57	1.50	1.31	1.41	1.36
	0.5	1.66	1.74	1.70	1.50	1.66	1.58
	1	1.55	1.61	1.58	1.73	1.84	1.78
	Lsd		0.094			0.016	0.011
				N			N
G*N	0	1.31	1.46	1.39	1.32	0.92	1.37
	50	1.57	1.64	1.60	1.49	1.65	1.57
	75	1.76	1.82	1.79	1.73	1.84	1.78
	Lsd		0.094	0.066		0.016	0.011
	G	1.55	1.64		1.51	1.63	
	Lsd		0.054			0.009	

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