

## EFFECTS OF AMMONIUM SULFATE AND SEAWEED EXTRACT (ALGA21ST) AS FOLIAR SPRAY TO NUTRITION CONTENT OF TWO CULTIVARS OF SWEET CHERRY (*PRUNUS AVIUM* L.) TRANSPLANTS

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### ABSTRACT

This study was conducted during the two growing seasons 2016 and 2017 in the lath house at the College of Agriculture, Duhok University, Kurdistan Region of Iraq. Uniform and healthy transplants of (2) years old sweet cherry (*Prunus avium* L.) cultivars (evey loly and shampion) were used. The effects of three levels of Ammonium sulfate ( $(\text{NH}_4)_2\text{SO}_4$ ) (as source of nitrogen) (0, 3 and 6 gm L<sup>-1</sup>), three levels of seaweed extracts (alga21st) concentrations (0, 1 and 2 gm.L<sup>-1</sup>) and their interactions on leaf nutrients status, the content of protein, carbohydrate were investigated. The results showed that cv. evey loly transplants significantly dominated over cv. shampion in leaf N concentration % and protein % (in second season), leaf S concentration % (in first season), leaf K concentration % and carbohydrates % (in both season), Ammonium sulfate at concentration 6 gm.L<sup>-1</sup> N significantly increased all traits in both seasons. Also treated sweet cherry transplant to different level of seaweed extract (alga21st) and especially at 2 gm.L<sup>-1</sup> significantly increased most characterized studied in both seasons. The interactions between cultivar and ammonium sulfate significantly enhanced all detected traits particularly interaction between (cv. evey loly and 6 gm.L<sup>-1</sup> N) in 2016 and 2017 seasons. Interaction between cultivar and alga21st significantly increased most characteristics in both study seasons. cv.evey loly with 2 gm.L<sup>-1</sup> gave positive significant of leaf N concentration % and leaf phosphorous concentration (in 2017 season), leaf K concentration, leaf S concentration %, protein % and carbohydrates % (in both seasons). While combination between cv.shampion and 2 gm.L<sup>-1</sup> significantly effect on the leaf P concentration % in first season (2016). Combination between ammonium sulfate and alga21st had the highest significant, The dual interaction between 6 gm.L<sup>-1</sup> N +2 gm.L<sup>-1</sup> alga21st significantly increased leaf N concentration %, leaf P concentration %and protein % (in second season), leaf K concentration and carbohydrate % (in both seasons), leaf S concentration % (in first season). On the other hand interaction between 6 gm.L<sup>-1</sup> N +1 gm.L<sup>-1</sup> had the highest significant in leaf N concentration %, leaf P concentration % and protein % (in first season). The interaction between cultivar +ammonium sulfate +alga21st significantly enhanced all studied traits in both study season.in first season the triple interaction between cv.evey loly +6 gm.L<sup>-1</sup> N +1 gm.L<sup>-1</sup> alga21st significantly increased on leaf N concentration % and protein %, while combination between cv.evey loly +6 gm.L<sup>-1</sup> N +2 gm.L<sup>-1</sup> alga21st had highest significant in leaf N concentration %, leaf P% and protein % (second season), leaf K concentration and carbohydrate % (in both seasons).

Keywords: Nitrogen, transplants, concentrations, evey loly, shampion.

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تأثير كبريتات الامونيوم و مستخلص البحري (Alga21st) كسماد الورقي على محتوى الغذائية في صنفين للشكلات الكرز

الحلو (*Prunus avium* L.) ايفي لولى وشامبيون

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### المستخلص

أجريت هذه الدراسة خلال الموسمين النمو 2016 و 2017 في الظل الخشبية تابعة لكلية الزراعة ، جامعة دهوك ، إقليم كردستان العراق. تم زراعة الشتلات للصنفين الكرز الحلو (*Prunus avium* L.) السليمة وخالية من الامراض و البالغة من العمر سنتين (ايفي لولى وشامبيون). ودرس فيه تأثيرات ثلاث مستويات من كبريتات الامونيوم  $(\text{NH}_4)_2\text{SO}_4$  (كمصدر للنيتروجين) (0، 3 و 6 غم.لتر<sup>-1</sup>) وثلاثة مستويات من مستخلصات الأعشاب البحرية (alga21st) (0، 1 و 2 غم.لتر<sup>-1</sup>) وتأثيرها المتداخلة على محتوى الورقة من العناصر الغذائية، البروتين والكربوهيدرات. أظهرت النتائج أن الصنف ايفي لولى تفوق معنويا على صنف شامبيون في تركيز محتوى الورقة من N ونسبة البروتين (في الموسم الثاني)، وتركيز محتوى الورقة من S (في الموسم الأول) ومحتوى الورقة من K والكربوهيدرات (في كلا الموسمين)، والرشد الورقي بكبريتات الامونيوم بتركيز 6 غم.لتر<sup>-1</sup> لاحظ زيادة جميع الصفات المدروسة في كلا الموسمين. ورشد الورقي من مستخلص الأعشاب البحرية (alga21st) وخاصة عند تركيز 2 غم.لتر<sup>-1</sup> لاحظت زيادة في معظم الصفات المدروسة. اما التداخل الثاني بين الصنف وكبريتات الامونيوم كانت لها تأثير معنوي على الصفات المدروسة خاصة في التداخل الثاني بين صنف ايفي لولى و تركيز 6 غم.لتر<sup>-1</sup> N في موسمين 2016 و 2017. اما التداخل الثاني بين الصنف و alga21st زاد بشكل كبير معظم الخصائص في كلا الموسمين الدراسة. أعطت ايفي لولى مع 2 غم.لتر<sup>-1</sup> تأثير معنوي من محتوى الورقة من N و P (في موسم 2017) وزيادة في K ، S ، نسبة البروتين والكربوهيدرات (في كلا الموسمين). في حين أن التداخل الثاني بين الصنف و 2 غم.لتر<sup>-1</sup> له تأثير كبير على زيادة محتوى الورقة من P في الموسم الأول (2016). في حين ان التداخل الثاني بين كبريتات الامونيوم و alga21st أعطى اعلى نسبة خاصة التداخل بين 6 غم.لتر<sup>-1</sup> N +2 غم.لتر<sup>-1</sup> alga21st زاد بشكل ملحوظ من الصفات التالية N ، P ، ونسبة البروتين (في الموسم الثاني)، و K ونسبة الكربوهيدرات (في كلا الموسمين) و S (في الموسم الأول). في حين ان التداخل بين 6 غم.لتر<sup>-1</sup> N +1 غم.لتر<sup>-1</sup> alga21st اعطى أعلى نسبة محتوى الورقة من P (في الموسم الأول). وأدى التداخل الثلاثي بين الصنف ايفي لولى + كبريتات الامونيوم + alga21st إلى زيادة كبيرة في جميع الصفات المدروسة في كلا من موسم الدراسة. في الموسم الأول، كان التداخل الثلاثي بين صنف ايفي لولى +6 غم.لتر<sup>-1</sup> N +1 غم.لتر<sup>-1</sup> alga21st تأثير ايجابي على محتوى الورقة من N ونسبة البروتين، في حين أن التداخل بين صنف ايفي لولى +6 غم.لتر<sup>-1</sup> N +2 غم.لتر<sup>-1</sup> alga21st كانت أعلى معنوية في تركيز P.N ونسبة البروتين (الموسم الثاني) ومحتوى الورقة من K والكربوهيدرات (في كلا الموسمين).

الكلمات المفتاحية: نايتروجين، الشتل، التراكيذ ، ايفي لولى ، شامبيون.

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## INTRODUCTION

The *Rosacea* is an important plant family that includes more than 90 genera and 3000 species where it divided into three subfamilies, two of which include some of the most economically important temperate fruit crops (30). The largest subfamily is the *Spiraoideae* to which *Malus* (apple), *Pyrus* (pear) and *Prunus* (peach, cherry, almond and apricot) belong. The second largest subfamily is the *Rosoideae* to which *Fragaria* (strawberry), *Rubus* (currants, black berries, raspberries) and *Rosa* (rose) belong. Cherries are members of the *Rosaceae* family, subfamily *Prunoideae*. *Prunus avium* L. is the sweet cherry, and *Prunus cerasus* L. is the sour, pie, or tart cherry. Sweet cherry is one of the most popular temperate fruits. According to the (19), cherries are an important horticultural crop produced worldwide, where approximately 2.2 million tons of cherries were produced worldwide in 2009. The total amount of sweet cherries produced in the United States from 2000 to 2016 was around 350 thousand tons. Around 40% of cherry world production originates in Europe. The biggest producers of cherries are Turkey, USA, Iran, Italy and Spain (12).

In fertilizing the pear seedlings, Al.Rawi and Ahmed (10) reported a significant increase in the proportion of N in the leaves, especially at highest levels compared to other treatments. This is consistent with the results of Al-Araji(3), which showed that there was a significant increase in the concentration of N in the leaves with increasing the level of N fertilizer added to the origin of citrus. Al-Janabi (8) explained that there was a significant increases in the concentration of N in the leaves with an increase in the level of N fertilizer. Al-Rawi and Nimer (11) reported that the N% in apple leaves increased in N-fertilized trees compared to non-fertilized. In their study, Al.Rawi and Ahmed (10) obtained the fertilization of seedlings of one-year-old seed pears with N fertilizer at four levels of 0, 20, 40 and 240 kg N ha<sup>-1</sup>. The addition of N fertilizer at a rate of 60 kg N / dunum caused a significant increase in leaf content from N compared to other treatments. Raese (31) found that when apple trees were planted at the age of 5 and 8 years, using different sources

and concentrations of N fertilizers, the high N fertilizer levels increased the N content of the leaves. Algae extract or seaweed extract as a new bio-fertilizer contained N, P, K, Ca, Mg, and S as well as Zn, Fe, Mn, Cu, Mo, and Co, some growth regulators, polyamines and vitamins which were applied to improve nutritional status, vegetative growth, yield and fruit quality in different orchard as well as vineyards (1 and 37). Ismaeal and Ghazzi (23) mentioned that the treatment of K18 and Khodeiri olive transplants with Marine fert. (12% natural organic matter extracted from seaweed (*Ascophyllum nodosum*) increased the concentrations of leaf N, P and K. Al-Hadethi and Al-Qatan (5) reported that seaweed extract increased the vegetative growth characteristics and leaf chlorophyll content of apricot trees. Bradshaw *et al.*, (15) found that spraying algae extracts of Stimplex and Seacrop16 extracted from seaweed *Ascophyllum nodosum* affected significantly the vegetative growth in apple trees. Al-Hadethi (6) revealed that spraying seaweed extract (Marine fert.) each at 2.5 and 5 ml.L<sup>-1</sup> enhanced leaf area, leaf chlorophyll content, leaf mineral content (N, K, Ca, Fe) and leaf carbohydrates content of apricot trees. Eman *et al.*, (18) showed that application of algae extract was very effective in stimulating the shoot length, leaf area, total leaf carbohydrates and leaf mineral content. Abd El-Motty *et al.*, (2) showed that spraying Keitte mango trees once at full bloom with algae at 2% combined with yeast at 0.2% was very effective and improved N, K and Br contents in the leaves. Haggag (21) showed olive seedling that combined with bio-stimulant based on algae extract (1%) gave the best results concerning lateral shoot numbers, stem diameter, leaves number, N, P and K %, whereas, algae extract alone achieved the highest plant height increment % lateral shoot numbers, Stem diameter, Leaves number. The aim of this study is to determine the effect of nitrogen and alga21st on NPK, carbohydrates and protein status of two cultivars of sweet cherry (*Prunus avium* L.) transplants leaves.

## MATERIALS AND METHODS

The experiment was conducted at the lath house, College of Agriculture, University of Duhok, Kurdistan region, Iraq during 2016 and 2017. Uniform and healthy transplants of (2)

years old sweet cherry (*Prunus avium* L.) cultivars (evey loly and shampion) were used. Evey loly is originated in turkey and shampion is originated in Syria. The experiments were started in February 15<sup>th</sup> 2016 by transplanting in black plastic pots (35 x 40 cm which hold 15 kg of soil). Pots were filled with mixture soil of clay and sand (1:1). Three ammonium sulfate (as source of Nitrogen) concentrations (0, 3 and 6 g. N L<sup>-1</sup>) in the form of (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> and 3 alga21st (seaweed extract) concentrations (0, 1 and 2 gm.L<sup>-1</sup>) were sprayed at 15<sup>th</sup> April 3 times within 20 days intervals. The experiment design was arranged in a Completely Randomized Block Design (RCBD); the experiment comprised of 18 treatments with 3 replicates, each replicate was presented by 3 pots each pot contained one transplant. The obtained data were tabulated and statistically analyzed by computer using SAS program (33). The differences among various treatment means were tested with Duncun multiple range test at (5%) level. Data collection three transplants were randomly selected from each experimental unit. The following parameters were determined in the: conducted, Leaf mineral content: Leaf samples were collected for chemical analysis at the 1<sup>st</sup> week of June of both seasons. Each sample 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 *et al.*, (16). Nitrogen was estimated by semi-micro kieldahl method of (29). Phosphorus was determined by the method outlined by Jackson (26). Potassium was determined using atomic absorption spectrophotometer “Perkin Elmer 1100B” after samples digested according to Chapman *et al.*, (16). Sulfur (%): it was determined with colorimetric method, after turbidity formation, using Spectrophotometer (pharmacia LKB) method at 420 nm (40). Protein (%) was calculated by multiplying the value of the nitrogen by 6.25 (4). Leaf carbohydrates content (%): was determined according to Dubois *et al.* (17).

## RESULTS AND DISCUSSION

It observe from the data in Table 1 that there was no significant differences between

cv. evey loly and cv. shampion in first season 2016, while in second season 2017 cv. evey loly significantly overtop in leaf nitrogen conc. and gave the maximum value (2.23 %) s compared to cv. shampion. Cherry transplant treated with iron rates substantially increased leaves nitrogen concentration at both two seasons especially at 6 gm.L<sup>-1</sup> N as compared to control, which recorded (2.21% in 2016 season and 2.35 % in 2017 season). The data shows that spraying transplant with alga21st had affected significantly on leaf nitrogen concentration in both seasons particularly at the concentration of 2 gml-1, which gave the highest value (2.12% in first season 2016 and 2.21 % in second season 2017).

Result indicated that the interaction between (cultivar and ammonium sulfate) significantly effect on leaf nitrogen concentration in both seasons. The best interaction was (cv. evey loly with 6 gm.L<sup>-1</sup> N) which resulted the highest nitrogen concentration (2.26% in 2016 season and 2.37 % in 2017 season) significantly differ when compared with other same interaction and control. In case of the interaction of (cultivar and alga21st), in 2016 season the higher leaf nitrogen concentration (2.17%) was obtained from combination between (cv. evey loly and 1 gm.L<sup>-1</sup>). On the other hand in second season the maximum value (2.30 %) was resulted from interaction between (cv. evey oly and 2 gm.L<sup>-1</sup>). The results indicated that the interaction between (ammonium sulfate and alga21st) has significantly effect on leaf nitrogen concentration in both seasons, in the first season (2016) the results indicated that the interaction between (6 gm.L<sup>-1</sup> N with 1 gm.L<sup>-1</sup>) was the most influential treatment, which gave the highest value (2.31%). Whereas in second season, the best interaction was (6 gm.L<sup>-1</sup> N with 2 gm.L<sup>-1</sup> alga21st) which gave the highest nitrogen concentration (2.46%).

Regarding the interaction between (cultivar, ammonium sulfate and alga21st), significantly affected leaf nitrogen concentration at both seasons. In the first season, the maximum value (2.34%) was observed when (cv. evey loly were sprayed with 6 gm.L<sup>-1</sup> N and 1 gm.L<sup>-1</sup> alga21st) at 2016 season, neverless the minimum value (1.85%) was donate at the interaction of (cv. shampion+0 gm.L<sup>-1</sup> N +

gm.L<sup>-1</sup>). Results in the second season, the highest value (2.48%) was acquired when (cv.evey loly were treated with 6 gm.L<sup>-1</sup> N and 2 gm.L<sup>-1</sup> alga21st), whereas the minimum value (1.90%) was recorded at the

interaction of (cv. shmpion +0 gm.L<sup>-1</sup> N). The highest leaf nitrogen concentration was resulted in 2017 season when compared with 2016 season.

**Table 1. Effect of cultivars, Ammonium sulfate, Alga21st and their interaction on leaf Nitrogen conc. (%) of sweet cherry transplant cvs. Shampion and Evey loly in (2016 and 2017) seasons.**

Cultivar	Nitrogen (gm)	First season 2016			CV.*N	Second season 2017			CV.*N
		Alga21st (gm)				Alga21st (gm)			
		0	1	2		0	1	2	
Shampion	0	1.85 d	1.98 b-d	1.95 b-d	1.93 c	1.90 f	1.88 f	1.92 ef	1.90 d
	3	1.91 cd	1.88 d	2.15 a-d	1.98 bc	1.99 d-f	2.15 b-f	2.00 d-f	2.04 cd
	6	1.96 b-d	2.28 ab	2.24 a-c	2.16 ab	2.15 b-f	2.43 ab	2.43 ab	2.34 a
Evey loly	0	1.97 b-d	2.06 a-d	1.91 cd	1.98 bc	2.05 c-f	2.11 b-f	2.13 b-f	2.10 bc
	3	1.90 d	2.11 a-d	2.17 a-d	2.06 bc	2.15 b-f	2.23 a-e	2.29 a-d	2.22 ab
	6	2.19 a-d	2.34 a	2.27ab	2.26 a	2.28 a-d	2.35 a-c	2.48 a	2.37 a
CV.× Alga21st	Shampion	1.91 b	2.05 ab	2.11 a	2.02 a	2.01 c	2.15 a-c	2.12 bc	2.09 b
	Evey loly	2.02 ab	2.17 a	2.12 a	2.10 a	2.16 a-c	2.23 ab	2.30 a	2.23 a
N × Alga21st	0	1.91 d	2.02 cd	1.93 d	1.95 b	1.98 d	2.00 d	2.02 cd	2.00 c
	3	1.91 d	2.00 cd	2.16 a-c	2.02 b	2.07 cd	2.19 cd	2.15 cd	2.13 b
	6	2.07 cd	2.31 a	2.25 ab	2.21 a	2.21 bc	2.39 ab	2.46 a	2.35 a
Means effect of Alga21st		1.96 b	2.11 a	2.12 a		2.09 b	2.19 ab	2.21 a	
2016			2.06 b			2017	2.16 a		

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range tests at 5% level.

Results in Table 2 shows that there were no significant differences in leaf phosphorous concentration in cv. evey loly and cv. shampion in both seasons (2016 and 2017). The obtained results in both seasons revealed that the spraying transplant with 6 gm.L<sup>-1</sup> N gave the better value of leaf phosphorous concentration which was (0.188 % in 2016 season and 0.211 % in 2017 season) respectively. The data show that spraying transplant with alga21st significantly affected leaf phosphorus concentration especially at the sprayed with 2 gm.L<sup>-1</sup> in both seasons, which was (0.186 % in 2016 and 0.212 % in 2017) significantly differ from control. Interaction between (cultivar and ammonium sulfate) had a significant effect on leaf phosphorous concentration in two seasons. The interaction treatment of (cv. evey loly + 6gm.L<sup>-1</sup> N) gave the significant highest leaf phosphorous concentration (0.190 % in 2016 and 0.215 % in 2017). Data reported that (cultivar and alga21st) interaction has a significant effect on

leaf phosphorous concentration in both seasons, the higher value (0.193 %) was observed from the interaction of cv. shampion with 2 gm.L<sup>-1</sup> alga21st in first season 2016, on the other hand, results obtained from second season displayed that the interaction cv. evey loly with 2 gm.L<sup>-1</sup> alga21st was the surpassed interaction and gave the highest value (0.217%). Concerning the interaction between (ammonium sulfate and alga21st), the effect was significant in both seasons, the higher value was obtained from interaction between (6 gm.L<sup>-1</sup> N +2 gm.L<sup>-1</sup> alga21st) was (0.191% in 2016 season and 0.231 % in 2017 season). Results of (cultivar, ammonium sulfate and alga21st) interaction mentioned that at the first season, the maximum leaf phosphorous concentration (0.200 %) was obtained at the treatment of ( cv. evey loly + 6 gm.L<sup>-1</sup> N+ 1 gm.L<sup>-1</sup> alga21st), whereas the minimum value (0.159 %) was gotten from the interaction of (cv. shampion +0 gm.L<sup>-1</sup> N+ 0 gm.L<sup>-1</sup> alga21st). in contrast, results recorded from the

second season displayed that the interaction among (cv. evey loly +6 gm.L<sup>-1</sup> N + 2 gm.L<sup>-1</sup> alga21st) was the superior interaction as it gave the highest value (0.236%).

Significantly, high leaf phosphorous concentration was obtained in 2017 season as compared to 2016 season.

**Table 2. Effect of cultivars, Ammonium sulfate, Alga21st and their interaction on leaf phosphorus conc. (%) of sweet cherry transplant cvs. Shampion and Evey loly in (2016 and 2017) seasons.**

Cultivar	Nitrogen (gm)	First season 2016			CV.*N	Second season 2017			CV.*N
		Alga21st (gm)				Alga21st (gm)			
		0	1	2		0	1	2	
Shampion	0	0.159 f	0.175 a-f	0.188 a-e	0.173 bc	0.155 d	0.184 cd	0.201 bc	0.180 c
	3	0.161 ef	0.178 a-f	0.190 a-d	0.176 a-c	0.179 cd	0.193 bc	0.197 bc	0.190 bc
	6	0.171 c-f	0.183 a-f	0.202 a	0.185 ab	0.185 cd	0.213 a-c	0.225 ab	0.208 ab
Evey loly	0	0.176 a-f	0.155 f	0.172 b-f	0.168 c	0.194 bc	0.18 cd	0.21 a-c	0.196 bc
	3	0.164 d-f	0.182 a-f	0.189 a-e	0.178 a-c	0.181 cd	0.19 bc	0.20 a-c	0.192 bc
	6	0.195 a-c	0.200 a	0.174 a-f	0.190 a	0.201 a-c	0.208 a-c	0.236 a	0.215 a
					Means effect of CV.				Means effect of CV.
CV.× Alga21st	Shampion	0.164 b	0.179 ab	0.193 a	0.179 a	0.173 c	0.196 b	0.208 ab	0.192 a
	Evey loly	0.178 ab	0.179 ab	0.178 ab	0.179 a	0.192 bc	0.195 b	0.217 a	0.201 a
					Means effect of Nitrogen				Means effect of Nitrogen
N × Alga21st	0	0.168 bc	0.165 bc	0.180 a-c	0.171 b	0.174 d	0.183 cd	0.21 bc	0.188 b
	3	0.162 c	0.180 a-c	0.190 a	0.177 b	0.180 cd	0.193 b-d	0.199 bc	0.191 b
	6	0.183 ab	0.191 a	0.188 a	0.188 a	0.193 b-d	0.210 ab	0.231 a	0.211 a
	Means effect of Alga21st	0.171 b	0.179 ab	0.186 a		0.182 c	0.196 b	0.212 a	
	2016		0.180 b			2017		0.197 a	

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range tests at 5% level.

Data in Table 3 displayed that there were significant differences between two cultivars evey loly and shampion in both seasons 2016 and 2017 and cv. evey loly was surpass on leaf potassium concentration and gave the highest value (1.51 %, 1.65 %) respectively. Results in Table 3 shows that spraying transplant with 6 gm.L<sup>-1</sup> N gave the highest significant value (1.51 % in first season and 1.70 % in second season). The data revealed in the first season (2016) that spraying transplant with alga 21st not affected significantly in leaf potassium concentration. While in second season (2017), the spraying of alga21st affected leaf potassium concentration especially at the third concentration (2 gm.L<sup>-1</sup> alga21st) which was (1.63%). In both seasons (2016, 2017), the interaction between (cultivar and ammonium sulfate) significantly affected leaf potassium concentration, and highest leaf potassium concentration value was observed between interaction of (cv. evey loly and 6 gm.L<sup>-1</sup> N) which gave (1.67% in 2016 season and 2.10 % in 2017 season) which was significantly differed when compared with other

concentration. There was a significant effect between (cultivar and alga21st) in both seasons on leaf potassium concentration especially at (cv.evey loly and 2 gm.L<sup>-1</sup>), which recorded the highest leaf potassium concentration (1.52% in 2016 season and 1.81 % in 2017 season) and significantly differences from other concentrations. About the interaction between (ammonium sulfate and alga21st) significantly affected leaf potassium concentration in both seasons, the highest leaf potassium concentration was acquired as a result of interaction between (6 gm.L<sup>-1</sup> N + 2 gm.L<sup>-1</sup> alga21st) which gave 1.64% in first season and 1.84 % in second season and significantly differed from same treatment and control. Results of (cultivar, ammonium sulfate and alga21st) interaction mentioned in both seasons there were significant effects on leaf potassium concentration. The maximum value (1.67% in 2016 season and 2.10 % in 2017) was obtained from interaction of (cv. evey loly+ 6 gm.L<sup>-1</sup> N +2 gm.L<sup>-1</sup>) and significantly differences when compared with other

concentration. The obtained results indicated that the leaf potassium concentration in 2017 season was superior over the 2016 season.

**Table 3. Effect of cultivars, Ammonium sulfate, Alga21st and their interaction on leaf potassium conc. (%) of sweet cherry transplant cvs. Shampion and Evey loly in (2016 and 2017) seasons.**

Cultivar	Nitrogen (gm)	First season 2016				CV.*N	Second season 2017			
		0	Alga21st (gm)				0	Alga21st (gm)		
			1	2			1	2		
Shampion	0	1.01 c	1.45 a-c	1.30 a-c	1.26 b	1.27 f	1.28	1.33 ef f	1.29 c	
	3	1.09 bc	1.33 a-c	1.50 a-c	1.31 b	1.43 ef	1.44 d-f	1.43 ef	1.43 bc	
	6	1.22 a-c	1.27 a-c	1.59 a-c	1.36 ab	1.44 d-f	1.49 c-f	1.58 d-e	1.50 b	
Evey loly	0	1.33 a-c	1.26 a-c	1.28 a-c	1.29 b	1.33 ef	1.45 d-f	1.60d-e	1.46 b	
	3	1.56 a-c	1.56 a-c	1.59 a-c	1.57 ab	1.43 ef	1.55 c-f	1.74 bc	1.57 b	
	6	1.64 ab	1.66 ab	1.69 a	1.67 a	1.73 b-d	1.89 ab	2.10 a	1.91 a	
					Means effect of CV.				Means effect of CV.	
CV.×	Shampion	1.11 b	1.35 ab	1.47 a	1.31 b	1.38 c	1.40 c	1.44 c	1.41 b	
Alga21st	Evey loly	1.51 a	1.49 a	1.52 a	1.51 a	1.50 bc	1.63 b	1.81 a	1.65 a	
					Means effect of Nitrogen				Means effect of Nitrogen	
N ×	0	1.17 b	1.36 ab	1.29 ab	1.27 b	1.30 e	1.37 de	1.46 c-e	1.38 c	
Alga21st	3	1.32 ab	1.45 ab	1.54 ab	1.44 ab	1.43 c-e	1.50 b-d	1.58 bc	1.50 b	
	6	1.43 ab	1.47 ab	1.64 a	1.51 a	1.59 bc	1.69 ab	1.84 a	1.70 a	
Means effect of Alga21st		1.31 a	1.42 a	1.49 a		1.44 b	1.52 b	1.63 a		
	2016		1.41 b			2017	1.53 a			

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range tests at 5% level.

Its clear from Table 4 that the highest leaf S concentration was recorded from cv. evey loly in first season which was (0.187%) in comparison with cv. shampion. Besides, in the second season (2017) there were no significant differences between the cultivars. Data in Table 4 illustrates that in both seasons, Ammonium sulfate at 6 gm.L<sup>-1</sup> N recorded the highest significant value of leaf sulfur concentration as compared with control treatment. Which was (0.200 % in 2016 season and 0.222% in 2017 season). The recorded data shows that in both seasons cherry transplant sprayed with different levels of alga21st particularly at 2 gm.L<sup>-1</sup> transplant levels, produced higher significant leaf sulfur concentration in comparison with control. Tabulated data declares that in both study seasons, there were significant interaction between cultivar and ammonium sulfate, especially at cv. evey loly + 6 gm.L<sup>-1</sup> N which gave the highest leaf S concentration (0.207% in first season and 0.229% in second season) respectively. Results in the same tables show that the highest significant leaf sulfur concentration (0.203% and 0.219 %) was

obtained in both study seasons respectively, as a result of the interaction between cv. evey loly + 2 gm.L<sup>-1</sup>). Results of ammonium sulfate and alga21st interaction revealed that spraying cherry transplant with 6 gm.L<sup>-1</sup> N+ 2 gm.L<sup>-1</sup> alga21st interaction resulted in the highest leaf sulfur concentration (0.220%) in 2016 season, while in second season (2017) the highest leaf sulfur concentration (0.234%) was obtained from interaction between 6 gm.L<sup>-1</sup> N + 1 gm.L<sup>-1</sup>. Results of cultivar, ammonium sulfate and alga21st interaction indicated that at the first season, the interaction among cv. evey loly +6 gm.L<sup>-1</sup> N + 2 gm.L<sup>-1</sup> was the most potent treatment as it gave the highest leaf sulfur concentration (0.222%), nevertheless the lowest value (0.130%) was recorded from interaction of cv. shampion + 0 gm.L<sup>-1</sup> N + 0 gm.L<sup>-1</sup> (Table 4). Results obtained from the second season displayed that the interaction among cv. shampion + 6 gm.L<sup>-1</sup> N + 1 gm.L<sup>-1</sup> gave the highest leaf sulfur concentration (0.243%), while the lowest value (0.169%) was gotten at the treatment of cv. shampion +0gm.L<sup>-1</sup> N+ 0 gm.L<sup>-1</sup>. The obtaining results

revealed that 2017 season was superior over 2016 season in leaf sulfur concentration.

**Table 4. Effect of cultivars, Ammonium sulfate, Alga21st and their interaction on leaf sulfur conc. (%) of sweet cherry transplant cvs. Shampion and Evey loly in (2016 and 2017) seasons.**

Cultivar	Nitrogen (gm)	First season 2016				Second season 2017			
		Alga21st (gm)			CV.*N	Alga21st (gm)			CV.*N
		0	1	2		0	1	2	
Shampion	0	0.130 g	0.141 fg	0.153 e-g	0.141 d	0.169 b	0.184 b	0.187 b	0.180 c
	3	0.157 d-g	0.182 a-e	0.192 a-e	0.177 bc	0.176 b	0.184 b	0.216 ab	0.192 bc
	6	0.154 fg	0.207 ab	0.219 a	0.193 ab	0.205 ab	0.242 a	0.201 ab	0.216 ab
Evey loly	0	0.151 fg	0.166 c-g	0.177 b-e	0.164 c	0.170 b	0.181 b	0.211 ab	0.187 c
	3	0.160 d-g	0.195 a-d	0.212 ab	0.189 ab	0.211 ab	0.200 ab	0.207 ab	0.206 a-c
	6	0.198 a-c	0.201 a-c	0.222 a	0.207 a	0.205 ab	0.243 a	0.239 a	0.229 a
CV.× Alga21st	Shampion	0.147 c	0.177 b	0.188 ab	0.170 b	0.183 b	0.203 ab	0.201 ab	0.196 a
	Evey loly	0.170 b	0.187 ab	0.203 a	0.187 a	0.195 ab	0.208 ab	0.219 a	0.205 a
N × Alga21st					Means effect of CV.				Means effect of CV.
	0	0.140 f	0.153 ef	0.165 d-f	0.153 c	0.170 d	0.182 cd	0.199 b-d	0.182 b
	3	0.158 ef	0.189 b-d	0.202 a-c	0.183 b	0.193 b-d	0.192 b-d	0.212 a-c	0.197 b
	6	0.176 c-e	0.204ab	0.220 a	0.200 a	0.205 b-d	0.243 a	0.220 ab	0.222 a
Means effect of Alga21st		0.158 b	0.182 a	0.196 a		0.192 b	0.201 ab	0.208 a	
		2016	0.179 b			2017	0.200 a		

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range tests at 5% level.

Table 5 reveals that there were no significant differences between two cultivars in the first season. Whereas in the second season, cv. evey loly was significantly differences from cv. shampion in protein % and gave (13.94%). In both seasons the spraying cherry transplant with 6 gm.L<sup>-1</sup> N concentration significantly increased leaf protein % and gave the highest value (13.82%, 14.71 %), respectively as compared to other treatment. The obtained results of both seasons 2016 and 2017 revealed that spraying transplant with alga21st rates resulted in significant increases in leaf protein %. Increases, particularly at 2 gm.L<sup>-1</sup> rate (13.22%, 13.80%) respectively, as compared to untreated check. The interactions between (cultivar and ammonium sulfate) had significant effect on leaf protein %. In both seasons, the highest leaf protein % (14.15 % in 2016 season and 14.81% in 2017 season) was recorded as a result of the interaction between (cv. evey loly with 6 gm.L<sup>-1</sup> N) and

significantly differ when compared with other treatment. The combination between cultivar and alga21st concentration displayed that cv.evey loly with 1 gm.L<sup>-1</sup> appeared to the most potent treatment in 2016 season, as it gave the highest leaf protein % (13.56%). On the other hand in second season the maximum leaf protein % was obtained as a result of interaction between cv.evey loly with 2 gm.L<sup>-1</sup> (14.38%) were accompanied to untreated check. Results in both seasons indicated that the interaction between (ammonium sulfate and alga21st) affected significantly on leaf protein %. The maximum leaf protein % was occurred as a result of the combination between (6 gm.L<sup>-1</sup> N +1 gm.L<sup>-1</sup>) which was (14.42%) in 2016 season, besides in second season 2017, the highest leaf protein % (15.35%) was acquired as a result of interaction between (6 gm.L<sup>-1</sup> N with 2 gm.L<sup>-1</sup>). Results indicated that the interaction between (cultivar+ ammonium

sulfate+alga21st) has significantly effect on leaf protein % at both seasons, in the first season results shows that the interaction of (cv. evey loly + 6 gm.L<sup>-1</sup> N + 1gm.L<sup>-1</sup>) was the most influential interaction treatment, which gave the highest value (14.60%). While in

second season, the best interaction was (cv. evey loly + 6 gm.L<sup>-1</sup> N +2gm.L<sup>-1</sup>) which gave the highest leaf protein % (15.50%) which was significantly different from other treatment. At both investigated seasons 2017 profoundly, exceeded 2016 season in protein%.

**Table 5. Effect of cultivars, Ammonium sulfate, Alga21st and their interaction on protein (%) of sweet cherry transplant leaves of cvs. Shampion and Evey loly in (2016 and 2017) seasons.**

Cultivar	Nitrogen (gm)	First season 2016			CV.*N	Second season 2017			CV.*N
		Alga21st (gm)				Alga21st (gm)			
		0	1	2		0	1	2	
Shampion	0	11.58 d	12.37 b-d	12.18 b-d	12.04 c	11.86 f	11.73 f	11.99 ef	11.86 d
	3	11.95 cd	11.77 d	13.44 a-d	12.38 c	12.43 d-f	13.42 b-f	12.50 d-f	12.78 cd
	6	12.24 b-d	14.24 ab	14.01 a-c	13.50 ab	13.44 b-f	15.20 ab	15.19 ab	14.61a
Evey loly	0	12.30 b-d	12.86 a-d	11.96 cd	12.37 c	12.84 c-f	13.21 b-f	13.30 b-f	13.12 bc
	3	11.87 d	13.20 a-d	13.58 a-d	12.88 bc	13.43 b-f	13.91 a-e	14.33 a-d	13.89 ab
	6	13.67 a-d	14.60 a	14.16 ab	14.15 a	14.23 a-d	14.69 a-c	15.50 a	14.81 a
CV.× Alga21st	Shampion	11.92 b	12.79 ab	13.21 a	12.64 a	12.58 c	13.45 a-c	13.23 bc	13.08 b
	Evey loly	12.61 ab	13.56 a	13.23 a	13.13 a	13.50 a-c	13.94 ab	14.38 a	13.94 a
N × Alga21st	0	11.94 d	12.62 cd	12.07 d	12.21 b	12.35 d	12.47 d	12.64 cd	12.49 c
	3	11.91 d	12. cd	13.51 a-c	12.63 b	12.93 cd	13.66 cd	13.41 cd	13.34 b
	6	12.95 b-d	14.42 a	14.09 ab	13.82 a	13.83 bc	14.94 ab	15.35 a	14.71 a
Means effect of Alga21st		12.27 b	13.17 a	13.22 a		13.04 b	13.69 ab	13.80 a	
		2016	12.89 b			2017	13.51 a		

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range tests at 5% level.

Its obvious from Table 6 that there was significant differences between two cultivar in both seasons 2016 and 2017, and the cv. evey loly significantly differ from cv. shampion on total carbohydrate %, the maximum % was obtained ( 15.25 % in 2016 season and 17 % in 2017 season).In both seasons, there was significantly impact of ammonium sulfate concentrations on total carbohydrate %, especially at the concentration of 6 gm.L<sup>-1</sup> N which gave the highest value (16.72 % in 2016 season and 17.86 % in 2017 season). It is clear from same Table that spraying cherry transplant with alga21st concentration causes a significant increase in the total carbohydrate % in both season, particularly at concentration of 2 gm.L<sup>-1</sup> which gave the maximum value (16.04 % in 2016 season and 17.70 % in 2017 season). The interaction between (cultivar and ammonium sulfate) illustrated that there were

significant effects on total carbohydrate % in both season. Where the highest value (17.24 % in 2016 season and 18.06 % in 2017 season) was obtained from (cv. evey loly and 6 gm.L<sup>-1</sup> ) treatment. Concerning the interaction between (cultivar and alga21st) in both seasons it has a significant effects on total carbohydrate %, the higher value (16.6 % in 2016 season and 18.94 % in 2017 season) was obtained from interaction between (cv. evey loly +2 gm.L<sup>-1</sup>).Data reported that (ammonium sulfate and alga21st) interaction had a significant effect on total carbohydrate % in both seasons, especially at the interaction between (6 gm.L<sup>-1</sup> N and 2 gm.L<sup>-1</sup>) which gave the highest value (18.92 % in 2016 season and 19.16 % in 2017 season).In respect with the interaction of the three studied factors, the interaction treatment of (cv. evey loly + 6 gm.L<sup>-1</sup> N + 2 gm.L<sup>-1</sup> alga21st) in both study



season (2016, 2017) gave the highest total carbohydrate % (19.15 % and 19.20 %) respectively and significantly differ from

control. The highest total carbohydrate % value (16.24%) was obtained in 2017 season and significantly differs from 2016 season.

**Table 6. Effect of cultivars, Ammonium sulfate, Alga21st and their interaction on total carbohydrate% (CHO) in leaves of sweet cherry transplant cvs. Champion and Evey loly in (2016 and 2017) seasons.**

Cultivar	Nitrogen (gm)	First season 2016			CV.*N	Second season 2017			CV.*N
		Alga21st (gm) 0	1	2		Alga21st (gm) 0	1	2	
Shampion	0	12.55 j	13.29 h-j	13.93 f-i	13.26 d	11.98 f	14.46 e	14.43 e	13.62 d
	3	14.13 f-i	14.28 e-h	15.12 c-f	14.51 c	14.66 de	14.91 c-e	15.85 c-e	15.14 c
	6	15.51 c-e	15.70 cd	17.36 b	16.19 b	16.21 c	17.68 b	19.12 a	17.67 a
Evey loly	0	13.00 ij	13.63 g-j	14.75 c-g	13.79 d	15.00 c-e	15.25 c-e	18.64 ab	16.30 b
	3	13.72 g-j	14.52 d-h	15.92 c	14.72 c	15.67 c-e	15.25 c-e	18.97 ab	16.63 b
	6	14.82 c-g	17.77 b	19.15 a	17.24 a	15.97 cd	19.01 ab	19.20 a	18.06 a
CV.× Alga21st	Shampion	14.06 c	14.42 c	15.47 b	14.65 b	14.28 d	15.68 c	16.47 b	15.48 b
	Evey loly	13.85 c	15.31 b	16.60 a	15.25 a	15.55 c	16.50 b	18.94 a	17.00 a
N × Alga21st	0	12.77 g	13.46 fg	14.34 e	13.52 c	13.49 e	14.85 d	16.54 bc	14.96 c
	3	13.93 ef	14.40 de	15.52 c	14.61 b	15.16 d	15.08 d	17.41 b	15.88 b
	6	15.16cd	16.74 b	18.26 a	16.72 a	16.09 c	18.35 a	19.16 a	17.86 a
	Means effect of Alga21st	13.95 c	14.86 b	16.04 a		14.92 c	16.09 b	17.70 a	
	2016		14.95 b			2017	16.24 a		

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range tests at 5% level.

These results are in harmony with those reported by on peach (9) where they found that plants treated with bio-stimulants increased the contents of N, P, K and S in leaves. From the results presented in Table 1, the levels of N fertilizer significantly affected the content of the leaves N and resulted in a direct increase in the % N. These results are consistent with the findings of Al-Rawi and Nemir (11), where the % N in apple leaves increased significantly in N-fertilized trees compared to non-fertilized trees. They also agreed with the results of (31) in the fertilization of one-year-old delicious apple seedlings, where it was observed that N fertilizer significantly increased the content of leaves of N compared to non-fertilized seedlings. The stimulating effect of seaweed extract on growth characters might be attributed to its essential action on enhancing cell division because it contains higher amounts of nutrients namely (N, P, K, Mg, Ca, S, Cus, Fe, Mn, B and Mo), natural hormones like cytokinins, IAA and GA3, amino acids, vitamins and antioxidants (27 and 36) these constituents play an important roles in

protecting plants cells from damage and all stresses around plants and improving cell division and the biosynthesis of organic foods (28).The positive effect of seaweed extract have been due to the content of the basic growth, such as nitrogen, phosphorus, potassium, vitamins, amino acids, organic and carbohydrate which have a wide range in their impact on the vital activity of the plant nutrients (32 ) thereby increasing absorbed by the plant. As for the effect of the algae extract turned out tables above that there is a significant effect and that this increase is due to contain the fertilizer nutrients especially the N, P and K which absorbs directly when sprayed on the leaves and thus an increase in the plant (35). These results are in agreement with those obtained by Saoir and Archer (32) on apple trees, Ismail *et al.* (24) on orange trees, Al-Hamadany (7) on peach trees and Al-Hadethi (6) on apricot trees. It is clear from studied parameters that the effect of ammonium sulfate on nutrient composition characteristics significantly affected and improved all parameters, the results may be

due to role of N in plants such as photosynthesis reactions, nucleic acid metabolism, protein and carbohydrate biosynthesis due to increased leaf mineral content (20). This is consistent with the results of Aitken and Senn (25). Al-Araji (3) found that the addition of N fertilizer resulted in a significant increase in the concentration of N. Also, results in Tables (1,2, 3,4 and 5) cleared that the % of algae extract especially at high concentration increased the N, P, K,S carbohydrates and protein in the leaves compared with control. From the above mentioned results it could be noticed that spraying seaweed extract at 200 ppm improved N, P and K contents in the leaves. These results are in agreement with those reported by (39); (22) and (38). According to the results of this study we can concluded that application of Ammonium sulfate and alga21st seaweed extract significant increasing nearly all traits undertaken in this study. And also from these results, it can be concluded that evey loly, leads to the Increased in content of NPK elements and Sulfar, carbohydrate and protein content. Furthermore the duet interactions among the tested factors were a positive effect in improving these traits.

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