RESPONSE OF ALMOND SEEDLING (*PRUNUS AMYGDALUS*) TO SPRAY OF AMINOPLASMAL, HUMIC ACID AND BORON.

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ABSTRACT

The present study was conducted at the nursery of the College of Agricultural Engineering Sciences; University of Duhok, Kurdistan Region, Iraq, during growing season (2020) to evaluate the effects of foliar sprays of three concentrations of aminoplasmal (0, 50 and 100 ml.L^{-1}), concentrations of humic acid (0, 100 and 200 ml.L^{-1}) and boron (0, 50 and 100 mg.L^{-1}) on vegetative growth and nutritional status of one year old almond seedling (*Prunus amygdalus*). The factorial experiment within randomized complete block design was used with three replicates. Foliar spraying applied at two times. First spray was carried out on 25th of April and the other on 27th of May. Results indicated that foliar spray of aminoplasmal at 100 ml.L^{-1} significantly increased all vegetative growth characteristics (stem length, stem diameter, number of branches/seedling, number of leaves / seedling, chlorophyll, leaf area, leaf fresh weight, leaf dry weight), and significantly increase leave nutritional status (N, P, K and B). Humic acid at conc. (200 ml.L^{-1}) and boric acid at conc. (100 mg.L^{-1}) cause significant increases in all studied traits. In combination, the triple interaction between 100 ml.L^{-1} aminoplasmal with 200 ml.L-1 humic acid and 100 mg.L^{-1} boron was the most affected one which surpassed significantly on the control treatment and other treatments. In general, in this study, it was discovered that treatments with aminoplasmal, humic acid and boron significantly increased vegetative growth and nutritional status of almond seedling.

Key words: nutrition, stem length, branches, boric acid.

استجابة نمو شتلات اللوز (*Prunus amygdalus*) لرش بالامينوبلازمال وحامض الهيوميك والبورون

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المستخلص

نفذت هذه الدراسة في المشتل التابع لكلية علوم الهندسة الزراعيه/جامعة دهوك/ اقليم كوردستان العراق خلال موسم النمو 2020 بهدف دراسة تاثير الرش الورقي لثلاث تراكيز من الامينوبلازمال (0, 50, 100 مل/لتر) وثلاث تراكيز من الهيوميك اسيد (0, 100, 200 مل/لتر) وثلاث تراكيز من البورون (0, 50, 100 ملغم/لتر) والتداخل بينهما على صفات النمو الخضري والحاله الغذائيه لشتلات اللوز بعمر سنه واحدة. نفذت التجربه كتجربه عامليه وفق تصميم القطاعات العشوائيه الكامله و بثلاثة مكررات. تم اجراء الرش الورقي بموعدين, الرشه الاولى كانت في 4/25 والثانيه في 5/27. تشير النتائج الى ان الرش الورقي لمادة الامينوبلازمال بتركيز (100مل/لتر) ادى الى زيادة معنويه في صفات النمو الخضري (طول الشتلة, قطر الساق ,عدد الافرع/شتله, عدد الاوراق /شتله, كلوروفيل, المساحة الورقيه, الوزن الطري للاوراق, الوزن الجاف للاوراق) وايضا ادى الى زيادة معنويه في محتوى الاوراق من العناصر الغذائيه (N, P, K, B). هيوميك اسيد بتركيز (200مل/لتر) وبوريك اسيد بتركيز (100ملغم/لتر) سبب زيادة معنويه في جميع الصفات المدروسه. بالنسبه للتداخلات بين المعاملات فان التداخل الثلاثي بين (100مل/لتر) امينوبلازمال و(200مل/لتر) هيوميك اسيد و (100ملغم/لتر) بورون هي الاكثر تاثيرا وقد تفوقت معنويا على معاملة المقارنه والمعاملات الاخرى. بصوره عامة بينت الدراسة ان المعاملة بالامينوبلازمال و الهيوميك اسيد والبورون خاصة بالتراكيز العالية ادى الى زيادة معنوية في صفات النمو الخضري والحاله الغذائيه لشتلات اللوز.

كلمات مفتاحية: تغذية، طول الساق، الافرع، حامض البوريك.

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INTRODUCTION

Almond (*Prunus amygdalus* B.) is a deciduous tree, it belongs to genus *Prunus,* subgenus *Amygdalus*. (27, 35). Related to the Rosaceae family that also includes apples, pears, prunes, and raspberries and is taxonomically related to other fruits species such as apricot and peach (26). Almonds are one of the oldest commercial nut crops of the world; from the Middle and West Asia, it has diffused to other regions and continents which include the Middle East, China, the Mediterranean region, and America (22). Amino acids are organic molecules that contain nitrogen, carbon, hydrogen, and oxygen, and have an organic side-chain in their structure, a characteristic that distinguishes the different amino acids (7,40). Also amino acid is a well-known bio-stimulant which has positive effects on plant growth (21). Yet amino acids are fundamental in chlorophyll production; chlorophyll being the driving force behind photosynthesis. Amino acids help to increase chlorophyll concentration in the plant, leading to higher degree of photosynthesis, which in turn leads to even more available energy (28). Nabi *et al* 2018 investigated the effect of aminoplasma, zinc and boron on vegetative growth of almond transplants. Accordingly, the obtained results reveal that the aminoplasmal at 200, and 250 $ml.L^{-1}$ significantly enhanced most studied parameters. Hassan *et al* 2010 applied amino acids to foliage plum trees caused a pronounced increase in leaf N, and K content. Humic acid can have direct effects on plant growth and causes an increase the growth of shoots and roots, absorption of nitrogen, potassium, phosphorus, calcium and magnesium by plant, and it improves plant physiological processes by increasing the availability of major and minor nutrients as well as by increasing the vitamin, amino acid and also auxin and cytokinine content of plants (9,29). The direct effect of humic acid compounds may have different biochemical effects either at cell wall, membrane level or in the cytoplasm, including increased respiration rates and photosynthesis in plants enhanced plant hormone- like activity and protein synthesis (11,42). Eisa *et al.* 2016 studied the effect of foliar application of humic acid on the growth and leaf mineral composition of Nonpareil almond seedlings. The results indicated that using humic acid as a foliar application resulted in improving vegetative growth and significantly increased leaf macro and micro-elements. Boron is a critical nonmetal immobile micronutrient, important for plant growth and development (36). It has a role in cell wall synthesis, structure and lignification, and plasma membrane integrity (38). Boron improves enzymes activity, promotes phytohormones and nucleic acids, activates nutrient uptake and mitigates plant tolerance to salinity, increases carbohydrates and sugars allocation, and stimulates phenols metabolism (20,24,43). Boron is an essential element required for optimal growth and development in higher plants (23). Boron may be applied to the soil or the foliage with good effect. Foliar fertilization has advantage of low application rates, uniform distribution of fertilizer materials, easiest method of application and quick responses to applied nutrients (20, 32). Keshavarz *et al* 2011 showed that foliar application of boron at ($200mg.L^{-1}$) has been reported to elevate the leaf chlorophyll and N content, thus increasing shoot growth, in Persian walnut. Acar *et al* 2016 showed that Tarımbor fertilizer containing 18.5% boron on two pistachio cultivars (‘Uzun’ and ‘Siirt’), resulted greater improvements in the boron content of leaves in both cultivars. Therefore, the aim of this study was to improve vegetative growth and nutritional status of almond seedling by using aminoplasmal, humic acid and boron spraying.

MATERIALS AND METHODS

This study was carried out during the growing season of 2020 in the nursery of the College Agricultural Engineering Sciences; University of Duhok , Kurdistan region, Iraq, in one year old almond seedling. The experiment included three concentration of Aminplasmal {Aminoplasmal B. Braun 10%} (0, 50 and $100ml.L^{-1}$), three concentration of humic acid (0, 100 and 200 $ml.L^{-1}$) and three concentration of boric acid {B approx. 17.48%} (0, 50, and 100 $mg.L^{-1}$), Treatments were consisted of 27 concentration treatments with three replicates; with five seedlings for each experimental unit (405 seedling). The spraying was carried out twice per season (first, 25 April and Second, month later). The

seedling was sprayed in the morning till runoff and the Tween-20 was added at 0.1 ml/L was used as a wetting agent. Factorial experiment was arranged within RCBD and the results were analyzed statistically using analysis of variance. The means were compared using Duncan's multiple range test at 5% probability (8). All the data were tabulated and statistically Analyzed with computer using (37). At the end of August the following characters will be measured:

1- Stem length (cm)
2- Stem diameter (mm).
3- Number of branches/seedling^{-1}.
4- Number of leaves/seedling^{-1}.
5- Leaf chlorophyll content by using chlorophyll meter (SPAD-502, Konica Minolta).
6- Leaf area (cm²) Leaf area was measured by a Digital Leaf Area Meter (ADC, Bio scientific LTD).
7- Leaf fresh weight (g).
8- Leaf dry weight (g)
9- Leaf mineral content (N, P, K and B).

Table 1. Qualitative and quantitative composition of Aminoplasmal 1000ml of solution contain

Acid name	Aminoplasmal B. Braun10%	Acid name	Aminoplasmal B. Braun10%
Isoleucine	**5.00g**	**Proline**	**5.50g**
Leucine	**8.90g**	**Aspartic acid**	**5.60g**
Lysinehydrochloride	**8.56g**	**Aspargine**	**3.68g**
Methionine	**4.40g**	**Asetyl Cysteine**	**0.68g**
Phenylalanine	**4.70g**	**Glutamic acid**	**7.20g**
Threonine	**4.29g**	**Tyrosine**	**0.40g**
Tryptophane	**1.60g**	**Serine**	**2.30g**
Valine	**6.20g**	**Acetyltyrosine**	**0.86g**
Arginine	**11.50g**	**Ornithinehydrochloride**	**3.20g**
Histidine	**3.00g**	**Total amino acids**	**100g/l**
Glycine	**12.00g**	**Total nitrogen**	**15.8g/l**
Alanine	**10.50g**		

RESULTS AND DISCUSSION

Stem length (cm): The data in Table 2 **explain** that foliar spray of amino plasmal cause significant increase in stem length when compared to control, the highest value (92.85cm) was obtained from 100 ml.L^{-1} amino plasmal. The same table illustrat that spraying almond seedling with humic acid at 200 ml.L^{-1} and boron at 100 mg.L^{-1} significantly increased stem length which gave the highest value (95.19 and 96.15 cm) respectively. Concerning the interaction between amino plasmal and humic acid it is declared that the combination of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid had the highest stem length (99.22cm) when compared to other treatment. In the interaction between amino plasmal and Boron, the highest value (99.11cm) was recorded at the interaction between 100 ml.L^{-1} amino plasmal x 100 mg.L^{-1} Boron. The same results also points the significant effects of interaction between humic acid and Boron, and the maximum significant value (103.00cm) was recorded by the combinations of 200 ml.L^{-1} humic acid and 100 mg.L^{-1} Boron. The interaction among the three studied factors, the maximum value (108.00 cm) was obtained from combination of 100 ml.L^{-1} amino plasmal x 200 ml.L^{-1} humic acid and 100 mg.L^{-1} Boron compared to lowest value (71.00 cm) was obtained from 0 ml.L^{-1} amino plasma x 0 ml.L^{-1} humic acid and 0 mg.L^{-1} Boron.

Table 2. Growth response of almond seedling (stem length (cm)) to the aminoplasmal, humic acid, boron and their interactions

Amino plasma	Humic acid	Boron 0	Boron 50	Boron 100	Amino plasma * Humic acid	Amino plasma
0	0	71.00 n	88.33 e-k	90.33 e-h	83.22 e	87.41 c
	100	83.00 lm	90.33 e-h	92.00 d-f	88.44 d	
	200	83.67 k-m	90.00 e-i	98.00 c	90.56 cd	
50	0	85.33 i-m	87.33 f-l	93.00 de	88.56 d	91.04 b
	100	85.00 j-m	89.67 e-j	91.67 d-f	88.78 cd	
	200	86.33 g-m	98.00 c	103.00 b	95.78 b	
100	0	82.00 m	89.33 e-j	93.00 de	88.11 d	92.85 a
	100	86.00 h-m	91.33 ef	96.33 cd	91.22 c	
	200	91.00 e-g	98.67 c	108.00 a	99.22 a	
Boron		83.70 c	91.44 b	96.15 a	Humic Acid	
Amino plasma	0	79.22 f	89.56 d	93.44 c	0	86.63 c
* Boron	50	85.56 e	91.67 cd	95.89 b	100	89.48 b
	100	86.33 e	93.11 c	99.11 a	200	95.19 a
Humic acid	0	79.44 h	88.33 ef	92.11 cd		
* Boron	100	84.67 g	90.44 de	93.33 bc		
	200	87.00 fg	95.56 b	103.00 a		

Means of each factor and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple range test at 5% level.

Stem diameter (mm): Table 3 shows that foliar application of amino plasmal cause significant increases in stem diameter of almond seedlings, the highest value (3.92mm) was obtained from 100 ml.L^{-1} amino plasmal. Foliar spray of humic acid caused a significant increase in stem diameter especially at (200 ml.L^{-1}) which gave the highest value (3.71mm). The spraying of Boron had significant effect on the stem diameter, the highest significant value (3.60mm) was obtained from100 mg.L^{-1} Boron. Regarding the combination between amino plasmal and humic acid table 3 shows that the interaction of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid had the highest value of stem diameter (4.50mm). The same table indicate that the interaction of 100 ml.L^{-1} amino plasmal x 100 mg.L^{-1} Boron and 200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron on stem diameter had the highest value (4.26mm and 4.11mm) respectively. The interactions of the three factors, the maximum value (5.24mm) was recorded from the interaction of 100 ml.L^{-1} amino plasmal x 200 ml.L^{-1} humic acid and 100 mg.L^{-1} Boron compared with the minimum value from 0 ml.L^{-1} amino plasmal x 0 ml.L^{-1} humic acid and 0 mg.L^{-1} Boron.

Table 3. Growth response of almond seedling (stem diameter (mm)) to the aminoplasmal, humic acid, boron and their interactions

Amino plasma	Humic acid	Boron 0	Boron 50	Boron 100	Amino plasmal * Humic acid	Amino plasma
0	0	2.05 k	2.17 jk	2.50 j	2.24 f	2.78 c
	100	2.17 jk	2.88 i	3.33 e-h	2.79 e	
	200	3.02 hi	3.27 e-h	3.63 de	3.31 d	
50	0	3.09 g-i	3.26 e-h	3.31 e-h	3.22 d	3.27 b
	100	3.13 f-i	3.27 e-h	3.39 d-h	3.26 d	
	200	3.35 d-f	3.20 f-i	3.46 d-g	3.34 cd	
100	0	3.31 e-h	3.72 cd	3.51 d-f	3.51 c	3.92 a
	100	3.65 de	3.62 de	4.02 bc	3.76 b	
	200	4.21 b	4.04 bc	5.24 a	4.50 a	
Boron		3.11 c	3.27 b	3.60 a	Humic Acid	
Amino plasmal	0	2.41 f	2.77 e	3.15 d	0	2.99 c
* Boron	50	3.19 cd	3.24 cd	3.39 c	100	3.27 b
	100	3.72 b	3.79 b	4.26 a	200	3.71 a
Humic acid	0	2.82 e	3.05 d	3.11 cd		
* Boron	100	2.98 de	3.26 c	3.58 b		
	200	3.53 b	3.50 b	4.11 a		

Means of each factor and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple range test at 5% level

Number of branches.seedling^{-1}: Results in Table 4 indicated that the spraying of amino plasmal had no significant effect on the number of branch per seedlings of almond seedlings. Foliar application of humic acid caused a significant increases in number of branch per seedlings especially at (200 ml.L^{-1}) which gave the highest value (4.63). It could be found from the study the significant differences in number of branch per seedlings from the spraying of 100 mg.L^{-1} Boron that gave highest value (4.81). Table 4 also illustrate significant effects of interaction between amino plasmal and humic acid on number of branch per plant, as results of the interaction between 100 ml.L^{-1} amino plasma and 200 ml.L^{-1} humic acid which recorded the highest number of branch per seedlings (4.89). For the interaction between amino plasmal and Boron, the highest value in number of branch per plant (4.89) was obtained in the interaction between (50 and 100) ml.L^{-1} amino plasmal x 100 mg.L^{-1} Boron. The interaction between humic acid at 200 ml.L^{-1} and Boron at 100 mg.L^{-1} had the highest significant value (5.89). The interactions of the three factors, the highest value (6.00) was recorded from the interaction of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid and 100 mg.L^{-1} Boron.

Table 4. Growth response of almond seedling (Number of branches/seedling) to the aminoplasmal, humic acid, boron and their interactions

Amino plasma	Humic acid	Boron 0	Boron 50	Boron 100	Amino plasmal * Humic acid	Amino plasma
0	0	3.33 cd	4.00 cd	4.00 cd	3.78 bc	4.00 a
	100	3.00 d	3.67 cd	4.33 b-d	3.67 c	
	200	3.33 cd	4.67 a-c	5.67 ab	4.56 ab	
50	0	3.67 cd	3.67 cd	4.67 a-c	4.00 bc	4.07 a
	100	3.00 d	4.33 b-d	4.00 cd	3.78 bc	
	200	3.00 d	4.33 b-d	6.00 a	4.44 a-c	
100	0	3.33 cd	3.67 cd	4.00 cd	3.67 c	4.19 a
	100	3.33 cd	4.00 cd	4.67 a-c	4.00 bc	
	200	4.33 b-d	4.33 b-d	6.00 a	4.89 a	
Boron		3.37 c	4.07 b	4.81 a	Humic acid	
Amino plasmal	0	3.22 d	4.11 a-c	4.67 ab	0	3.81 b
* Boron	50	3.22 d	4.11 a-c	4.89 a	100	3.81 b
	100	3.67 cd	4.00 b-d	4.89 a	200	4.63 a
Humic acid	0	3.44 de	3.78 b-e	4.22 b-d		
* Boron	100	3.11 e	4.00 b-d	4.33 bc		
	200	3.56 c-e	4.44 b	5.89 a		

Means of each factor and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple range test at 5% level

Number of leaves/seedling: Table 5 illustrate that the spraying Almond seedling with 100 ml.L^{-1} amino plasmal and 200 ml.L^{-1} humic acid and 100 mg.L^{-1} Boron significantly increased the number of leaves per seedlings which gave the highest value (98.54 , 97.52 and 99.70) respectively. Regarding the interaction of amino plasmal x humic acid, amino plasmal x Boron, humic acid x Boron, maximum significant value (106.11, 109.00 and 103.78) was resulted from the interaction of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid, 100 ml.L^{-1} amino plasma x 100 mg.L^{-1} Boron and 200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron gave the maximum value respectively. In respect, the interaction of the three study factors, the interaction of 100 ml.L^{-1} amino plasmal x 200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron gave the highest value (113.33) compared to lowest value (60.00) from the interaction of 0 ml.L^{-1} amino plasma, 0 ml.L^{-1} humic acid and 0 mg.L^{-1} Boron .

Table 5. Growth response of almond seedling (Number of leaves/ Seedling) to the aminoplasmal, humic acid, boron and their interactions

Amino plasma	Humic acid	Boron 0	Boron 50	Boron 100	Amino plasmal * Humic acid	Amino plasma
0	0	60.00 m	84.00 h-j	85.00 g-j	76.33 e	84.04 b
	100	71.33 kl	85.00 g-j	93.67 d-g	83.33 d	
	200	85.00 g-j	94.67 d-f	97.67 c-f	92.44 bc	
50	0	70.67 l	83.67 ij	98.67 c-f	84.33 d	86.63 b
	100	67.67 lm	82.00 ij	95.00 d-f	81.56 d	
	200	91.67 e-i	90.00 f-i	100.33 c-e	94.00 bc	
100	0	79.50 jk	93.33 e-g	103.33 b-d	92.06 c	98.54 a
	100	83.00 ij	99.00 c-f	110.33 ab	97.44 b	
	200	98.00 c-f	107.00 a-c	113.33 a	106.11 a	
Boron		78.54 c	90.96 b	99.70 a	Humic acid	
Amino plasmal	0	72.11 e	87.89 cd	92.11 c	0	84.24 c
* Boron	50	76.67 e	85.22 d	98.00 b	100	87.44 b
	100	86.83 d	99.78 b	109.00 a	200	97.52 a
Humic acid	0	70.06 e	87.00 d	95.67 bc		
* Boron	100	74.00 e	88.67 d	99.67 ab		
	200	91.56 cd	97.22 b	103.78 a		

Means of each factor and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple range test at 5% level

Leaf chlorophyll content (%): It's clear from Table 6 that spraying Almond seedling with 100 $ml.L^{-1}$ amino plasmal and 200 $ml.L^{-1}$ humic acid and 100 $mg.L^{-1}$ Boron significantly increased leaf chlorophyll content which gave the highest value (51.78, 51.91 and 52.70) respectively. For the table 6 indicated that interactions of amino plasmal x humic acid, amino plasma x Boron, humic acid x Boron were significantly differed from most of others interactions. The highest values (53.86, 54.39 and 55.94%) were with the interaction of 100 $ml.L^{-1}$ amino plasmal x 200 $ml.L^{-1}$ humic acid, 100 $ml.L^{-1}$ amino plasmal x 100 $mg.L^{-1}$ Boron and 200 $ml.L^{-1}$ humic acid x 100 $mg.L^{-1}$ Boron respectively. For the interaction between the three study factors in same table shows that the highest value (57.90) was obtained with the combination among 100 $ml.L^{-1}$ amino plasmal, 200 $ml.L^{-1}$ humic acid and 100 $mg.L^{-1}$ Boron compared to the lowest Chlorophyll content (39.40) at 0 $ml.L^{-1}$ amino plasmal, 0 $ml.L^{-1}$ humic acid and 0 $mg.L^{-1}$ Boron.

Table 6. Growth response of almond seedling (Leaf chlorophyll content (%)) to the amino plasmal, humic acid, boron and their interactions

Amino plasma	Humic acid	Boron 0	Boron 50	Boron 100	Amino plasmal * Humic acid	Amino plasma
0	0	39.40 m	42.67 l	45.00 kl	42.36 d	47.40 c
	100	46.67 i-k	48.67 f-i	51.73 c-f	49.02 c	
	200	46.33 i-k	50.63 d-g	55.50 ab	50.82 b	
50	0	45.57 jk	50.30 d-h	53.13 b-d	49.67 bc	50.03 b
	100	46.20 i-k	50.50 d-g	51.33 c-g	49.34 bc	
	200	47.33 h-k	51.43 c-g	54.43 bc	51.07 b	
100	0	48.27 g-j	51.17 d-g	52.23 c-e	50.56 bc	51.78 a
	100	49.23 e-i	50.50 d-g	53.03 b-d	50.92 b	
	200	50.83 d-g	52.83 b-d	57.90 a	53.86 a	
Boron		46.65 c	49.86 b	52.70 a	Humic acid	
Amino plasmal	0	44.13 f	47.32 e	50.74 cd	0	47.53 c
* Boron	50	46.37 e	50.74 cd	52.97 ab	100	49.76 b
	100	49.44 d	51.50 bc	54.39 a	200	51.91 a
Humic acid	0	44.41 f	48.04 e	50.12 cd		
* Boron	100	47.37 e	49.89 d	52.03 b		
	200	48.17 e	51.63 bc	a 55.94		

Means of each factor and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple range test at 5% level

Leaf area (cm^2): results in Table 7 show that the spraying Almond seedling with 100 $ml.L^{-1}$ amino plasma and 200 $ml.L^{-1}$ humic acid and 100 $mg.L^{-1}$ Boron significantly increased the

leaf area which give the highest value (3.45, 3.28 and 3.19) respectively. Regarding the interaction of amino plasma x humic acid, amino plasma x Boron, humic acid x Boron, maximum significant value (4.32, 3.65 and 3.49) was resulted from the interaction of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid, 100 ml.L^{-1} amino plasma x 100 mg.L^{-1} Boron and 200 ml.L^{-1} humic acid x 50 mg.L^{-1} Boron gave the maximum value respectively. In respect, the interaction of the three study factors, the interaction of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron gave the highest value (4.51) compared to lowest value (1.89) from the interaction of 0 ml.L^{-1} amino plasma, 0 ml.L^{-1} humic acid and 0 mg.L^{-1} Boron.

Table 7. Growth response of almond seedling (leaf area (cm²)) to the amino plasma, humic acid, boron and their interactions

Amino plasma	Humic acid	Boron 0	Boron 50	Boron 100	Amino plasmal * Humic acid	Amino plasma
0	0	1.89 o	2.41 kl	2.60 hi	2.30 f	2.35 c
	100	2.04 n	2.30 lm	2.88 g	2.41 e	
	200	2.11 n	2.64 hi	2.26 m	2.34 f	
50	0	2.02 n	2.40 kl	2.90 g	2.44 e	2.72 b
	100	2.33 lm	2.61 hi	2.66 h	2.53 d	
	200	2.54 ij	3.34 d	3.66 c	3.18 b	
100	0	2.46 jk	3.00 fg	3.02 f	2.83 c	3.45 a
	100	2.99 fg	3.17 e	3.43 d	3.19 b	
	200	3.97 b	4.48 a	4.51 a	4.32 a	
Boron		2.48 c	2.93 b	3.10 a	Humic acid	
Amino plasmal * Boron	0	2.01 i	2.45 g	2.58 f	0	2.52 c
	50	2.30 h	2.78 e	3.07 d	100	2.71 b
	100	3.14 c	3.55 b	3.65 a	200	3.28 a
Humic acid * Boron	0	2.12 g	2.60 e	2.84 c		
	100	2.45 f	2.69 d	2.99 b		
	200	2.87 c	3.49 a	3.48 a		

Means of each variable and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple range test at 5% level.

Leaf fresh weight (g): Data in Table 8 reveal that foliar application of amino plasma had no significant effect on the leaf fresh weight in leaf of almond seedlings. spraying Almond seedling with 200 ml.L^{-1} humic acid and 100 mg.L^{-1} Boron significantly increased the Leaf fresh weight which gave the highest value (7.91g and 7.94g) respectively.. The interaction of amino plasma x humic acid affected significantly on leaf fresh weight, the maximum value (8.27g) was obtained from the interaction treatment (100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid). Almond seedling treated with 0 ml.L^{-1} amino plasma and 100 mg.L^{-1} Boron gave the highest significant value (8.18g). Then, the combinations between humic acid and Boron also effected significantly on leaf fresh weight of almond seedling, since the maximum average (8.33g) was obtained from the combination (200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron). Therefore, the combinations among three factors significantly differed; the maximum average (8.92 g) was recorded from the combination of 0 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron.

Table 8. Growth response of almond seedling (leaf fresh weight (g)) to the amino plasma, humic acid, boron and their interactions

Amino plasma	Humic acid	Boron 0	Boron 50	Boron 100	Amino plasmal * Humic acid	Amino plasma
0	0	1.89 o	2.41 kl	2.60 hi	2.30 f	2.35 c
	100	2.04 n	2.30 lm	2.88 g	2.41 e	
	200	2.11 n	2.64 hi	2.26 m	2.34 f	
50	0	2.02 n	2.40 kl	2.90 g	2.44 e	2.72 b
	100	2.33 lm	2.61 hi	2.66 h	2.53 d	
	200	2.54 ij	3.34 d	3.66 c	3.18 b	
100	0	2.46 jk	3.00 fg	3.02 f	2.83 c	3.45 a
	100	2.99 fg	3.17 e	3.43 d	3.19 b	
	200	3.97 b	4.48 a	4.51 a	4.32 a	
Boron		2.48 c	2.93 b	3.10 a	Humic acid	
Amino plasmal	0	2.01 i	2.45 g	2.58 f	0	2.52 c
* Boron	50	2.30 h	2.78 e	3.07 d	100	2.71 b
	100	3.14 c	3.55 b	3.65 a	200	3.28 a
Humic acid	0	2.12 g	2.60 e	2.84 c		
* Boron	100	2.45 f	2.69 d	2.99 b		
	200	2.87 c	3.49 a	3.48 a		

Means of each factor and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple range test at 5% level

Leaf dry weight (g): Results in Table 9 indicate that foliar application of amino plasmal had no significant effect on the leaf dry weight in leaf of almond seedlings. While, humic acid significantly affected leaf dry weight, there was (200 ml.L^{-1}) had the highest significant value of leaf dry weight (1.58g). Also results show that the spraying (100 mg.L^{-1}) of Boron had significant effect on leaf dry weight (1.59g). The interaction of amino plasma x humic acid affected significantly on leaf dray weight, the maximum value was obtained (1.65g) from the interaction treatment (100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid). Almond seedling treated with 0 ml.L^{-1} amino plasma and 100 mg.L^{-1} Boron gave the highest significant value (1.64) which significantly surpassed to the lowest value. Then, the combinations between humic acid and Boron also effected significantly on leaf dry weight of almond seedling, since the maximum value (1.67g) was obtained from treatment combination (200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron). Therefore, the combination among three factors significantly differed; the maximum mean (1.78g) was recorded from the combination of 0 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron.

Table 9. Growth response of almond seedling (leaf dry weight (g)) to the amino plasma, humic acid, boron and their interactions

Amino plasmal	Humic acid	Boron 0	Boron 50	Boron 100	Amino plasmal * Humic acid	Amino plasma
0 ppm	0	6.16 o	7.08 kl	7.72 ef	6.99 g	7.43 a
	100	7.00 lm	7.12 j-l	7.91 de	7.34 ef	
	200	7.40 g-j	7.53 f-i	8.92 a	7.95 b	
50 ppm	0	7.24 i-l	7.37 g-k	8.40 b	7.67 c	7.47 a
	100	7.17 j-l	7.16 j-l	7.30 h-l	7.21 f	
	200	7.32 h-k	7.59 f-h	7.63 e-g	7.52 d	
100 ppm	0	6.51 n	6.65 n	7.07 kl	6.74 h	7.49 a
	100	6.78 mn	7.48 f-i	8.06 cd	7.44 de	
	200	8.08 cd	8.32 bc	8.42 b	8.27 a	
Boron		7.07 c	7.37 b	7.94 a	Humic acid	
Amino plasmal	0	6.85 f	7.25 de	8.18 a	0	7.13 c
* Boron	50	7.24 de	7.37 cd	7.78 b	100	7.33 b
	100	7.13 e	7.48 c	7.85 b	200	7.91 a
Humic acid	0	6.64 f	7.03 e	7.73 bc		
* Boron	100	6.98 e	7.25 d	7.76 bc		
	200	7.60 c	7.81 b	8.33 a		

Means of each factor and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple range test at 5% level

Nitrogen content in leaves (%): results in Table 10 show that the spraying Almond seedling with 100 ml.L^{-1} amino plasma and 200 ml.L^{-1} humic acid and 100 mg.L^{-1} Boron significantly increased Nitrogen content in leaves which gave the highest value (2.157, 2.476 and 2.261) respectively. Regarding the interaction of amino plasma x humic acid, amino plasma x Boron, humic acid x Boron, maximum significant value (2.694, 2.450 and 2.739) was resulted from the interaction of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid, 100 ml.L^{-1} amino plasma x 100 mg.L^{-1} Boron and 200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron gave the maximum value respectively. In respect, the interaction of the three study factors, the interaction of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron gave the highest value (3.250) compared to lowest value (0.613) from the interaction of 0 ml.L^{-1} amino plasma, 0 ml.L^{-1} humic acid and 0 mg.L^{-1} Boron.

Table 10. Growth response of almond seedling (Nitrogen content in leaves (%)) to the amino plasma, humic acid, boron and their interactions

Amino plasma	Humic acid	Boron 0	Boron 50	Boron 100	Amino plasmal * Humic acid	Amino plasma
	0	1.16 n	1.42 i-l	1.54 de	1.37 f	
0	100	1.40 kl	1.42 i-l	1.58 cd	1.47 de	1.48 a
	200	1.48 e-j	1.51 e-h	1.78 a	1.59 b	
	0	1.45 g-k	1.47 e-k	1.68 b	1.53 c	
50	100	1.43 h-k	1.43 h-k	1.46 f-k	1.44 e	1.49 a
	200	1.46 f-k	1.52 d-g	1.53 d-f	1.50 cd	
	0	1.30 m	1.33 m	1.41 j-l	1.35 f	
100	100	1.36 lm	1.50 d-g	1.61 bc	1.49 d	1.50 a
	200	1.62 bc	1.66 b	1.68 b	1.65 a	
Boron		1.41 c	1.47 b	1.59 a	Humic acid	
Amino plasmal * Boron	0	1.35 f	1.45 de	1.64 a	0	1.42 c
	50	1.45 de	1.47 cd	1.56 b	100	1.47 b
	100	1.43 e	1.50 c	1.57 b	200	1.58 a
Humic acid * Boron	0	1.30 f	1.41 e	1.55 bc		
	100	1.40 e	1.45 d	1.55 bc		
	200	1.52 c	1.56 b	1.67 a		

Means of each factor and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple range test at 5% level

Phosphorus content in leaves (%): As showi in table 11 spraying amino plasma cause significant increases in Phosphorus content in leaves, the highest value (0.533) was obtained from 100 ml.L^{-1} amino plasma. Results of Table 11 illustrate that almond seedling sprayed with humic acid was enhancing Phosphorus content in leaves with obtained significant effect, sprays with 200 ml.L^{-1} humic acid gave the highest value (0.434). It is obvious from the same table that there was significant effect of Boron on the Phosphorus content in leaves particularly spraying at 100 mg.L^{-1} concentration which gave the highest value (0.441). Concerning the interaction between amino plasma and humic acid it is declared that there was a significant effect on the Phosphorus content in leaves, the treatment combination of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid gave the highest Phosphorus content in leaves (0.576). In the interaction between amino plasma and Boron effected significantly on the Phosphorus content in leaves that record the highest value (0.573) at the interaction between 100 ml.L^{-1} amino plasma x 100 mg.L^{-1} Boron. Table 11 points the significant effect of interaction between humic acid and Boron, and the maximum significant value (0.482) was recorded by the combinations of 200 ml.L^{-1} humic acid and 100 mg.L^{-1} Boron The interaction among the three studied factors significantly affected on the Phosphorus content in leaves. The maximum value (0.653) was obtained from combination of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid and 100 mg.L^{-1} Boron compared to lowest value (0.210)) was obtained from 0 ml.L^{-1} amino plasma x 0 ml.L^{-1} humic acid and 0 mg.L^{-1} Boron.

Table 11. Growth response of almond seedling (Phosphorus content in leaves (%)) to the amino plasma, humic acid, boron and their interactions

Amino plasma	Humic acid	Boron 0 ppm	Boron 50 ppm	Boron 100 ppm	Amino plasmal * Humic acid	Amino plasma
0	0	0.613 n	1.150 l	1.650 i-k	1.138 b	1.824 c
	100	1.550 jk	1.983 e-i	2.217 c-g	1.917 c	
	200	2.250 b-g	2.450 b-d	2.550 bc	2.417 b	
50	0	1.747 mn	1.350 kl	1.783 h-j	1.293 e	1.953 b
	100	1.083 lm	2.283 b-g	2.383 b-e	2.250 b	
	200	2.183 c-h	2.350 b-f	2.417 b-d	2.317 b	
100	0	1.083 d-h	1.917 g-i	1.650 i-k	1.550 d	2.157 a
	100	2.950 f-j	2.283 b-g	2.450 b-d	2.228 b	
	200	2.183 c-h	2.650 b	3.250 a	2.694 a	
Boron		1.627 c	2.046 b	2.261 a	Humic acid	
Amino plasmal	0	1.471 f	1.861 de	2.139 bc	0	1.327 c
* Boron	50	1.671 ef	1.199 cd	2.194 bc	100	2.131 b
	100	1739 e	2.283 ab	2.450 a	200	2.476 a
Humic acid	0	0.814 f	1.472 e	1.694 d		
* Boron	100	1.861 d	2.183 c	2.350 bc		
	200	2.206 c	2.483 b	2.739 a		

Means of each factor and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple range test at 5% level

Potassium content in leaves (%): Data in Table 12 Illustrates that the spraying Almond seedling with 100 ml.L^{-1} amino plasma and 200 ml.L^{-1} humic acid significantly increased Potassium content in leaves and gave the maximum value (2.193 and 2.392). sprays with 100 mg.L^{-1} boron gave the highest value (2.130). Regarding the interaction of amino plasma x humic acid, amino plasma x Boron, humic acid x Boron, maximum value (2.411, 2.326 and 2.478) was resulted from the interaction of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid, 100 ml.L^{-1} amino plasma x 50 mg.L^{-1} Boron and 200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron gave the maximum value respectively. In respect, the interaction of the three study factors, the interaction of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron gave the highest value (2.567) compared to lowest value (1.267) from the interaction of 50 ml.L^{-1} amino plasma, 0 ml.L^{-1} humic acid and 0 mg.L^{-1} Boron.

Table 12. Growth response of almond seedling (Potassium content in leaves (%)) to the amino plasma, humic acid, boron and their interactions

Amino plasmal	Humic acid	Boron 0	Boron 50	Boron 100	Amino plasmal * Humic acid	Amino plasma
0	0	0.210 p	0.280 no	0.293 n	0.261 g	0.327 c
	100	0.310 l-n	0.337 k-m	0.36 3jk	0.337 e	
	200	0.363 jk	0.380 h-j	0.410 g-i	0.384 d	
50	0	0.250 o	0.307 l-n	0.367 jk	0.308 f	0.351 b
	100	0.370 h-k	0.407 gh	0.433 fg	0.403 d	
	200	0.300 mn	0.347 j-l	0.383 h-j	0.343 e	
100	0	0.470 ef	0.500 c-e	0.527 b-d	0.499 c	0.533 a
	100	0.490 de	0.543 b	0.540 bc	0.524 b	
	200	0.520 b-d	0.553 b	0.653 a	0.576 a	
Boron		0.365 c	0.406 b	0.441 a	Humic acid	
Amino plasmal	0	0.294 g	0.332 f	0.356 e	0	0.356 c
* Boron	50	0.307 g	0.353 ef	0.394 d	100	0.421 b
	100	0.493 c	0.532 b	0.573 a	200	0.434 a
Humic acid	0	0.310 e	0.362 d	0.396 c		
* Boron	100	0.390 c	0.429 b	0.446 b		
	200	0.394 c	0.427 b	0.482 a		

Means of each factor and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple range test at 5% level

Boron content in leaves: Results in Table 13 Indicate that the spraying Almond seedling with 100 ml.L^{-1} amino plasma and 200 ml.L^{-1} humic acid and 100 mg.L^{-1} Boron significantly increased the Boron content in leaves and had the highest value (26.542, 26.699 and 30.977).

Regarding the interaction of amino plasma x humic acid, amino plasma x Boron, humic acid x Boron, maximum significant value (30.042, 34.007 and 35.341) was resulted from the interaction of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid, 100 ml.L^{-1} amino plasma x 100 mg.L^{-1} Boron and 200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron gave the maximum value respectively. In respect, the interaction of the three study factors, the interaction of 100 ml.L^{-1} amino plasma x 200 ml.L^{-1} humic acid x 100 mg.L^{-1} Boron gave the highest value (41.567) compared to lowest value (14.920) from the interaction of 50 ml.L^{-1} amino plasma, 0 ml.L^{-1} humic acid and 0 mg.L^{-1} Boron**.**

Table 13. Growth response of almond seedling (Boron content in leaves (%)) to the amino plasma, humic acid, boron and their interactions

Amino plasmal	Humic acid	Boron 0	Boron 50	Boron 100	Amino plasmal * Humic acid	Amino plasma
0	0	1.367 no	1.467 no	1.700 lm	1.511 d	1.943 b
	100	1.900 j-l	1.800 kl	2.167 e-i	1.956 c	
	200	2.267 c-g	2.330 b-f	2.493 ab	2.363 a	
50	0	1.267 o	1.567 mn	1.833 kl	1.556 d	1.986 b
	100	1.700 lm	2.100 g-j	2.200 e-g	2.100 bc	
	200	2.367 a-e	2.467 a-c	2.373 a-e	2.402 a	
100	0	2.130 g-j	2.243 c-g	1.867 kl	2.080 b	2.193 a
	100	2.000 h-k	2.300 b-g	1.967 i-k	2.089 b	
	200	2.233 d-g	2.433 a-d	2.567 a	2.411 a	
Boron		2.214 b	2.079 a	2.130 a	Humic acid	
Amino plasmal	0	1.914 c	1.866 c	2.120 b	0	1.716 c
* Boron	50	1.844 c	2.044 b	2.136 b	100	2.015 b
	100	2.121	2.326 a	2.133 b	200	2.392 a
Humic acid	0	1.588 e	1.759 d	1.800 d		
* Boron	100	1.867 d	2.067 c	2.111 c		
	200	2.289 b	2.410 a	2.478 a		

Means of each factor and their interactions followed with the same letters are not significantly different from each other's according to Duncan's multiple range test at 5% level.

The results of this research showed that, the most examined treatments had a positive influence on all vegetative growth parameters (stem length, stem diameter, number of branches / seedling, number of leaves / seedling, chlorophyll, leaf area, leaf fresh weight, leaf dry weight) and also significant increased leaf nutrient content (N,P,K,B). Increasing vegetative growth and leaf chlorophyll content by foliar spray with aminoplasmal could be attributed to the role of aminoplasmal as precursors and constituents of the proteins (34, 14), which are important for stimulation of cell growth. They contain both acid and basic groups and act as buffers, which help to maintain favorable or indirectly influence the physiological activities in plant growth and development in increasing cell division and elongation and its role in enhancement of metabolite accumulation in leaves, also to increasing photosynthesis which leads to increase chlorophyll content in the leaves (1). The present results are in agreement with the finding obtained by (28) who concluded that Amino acids are fundamental in chlorophyll production; Chlorophyll being the driving force behind photosynthesis. Amino acids can also be an important source of available nitrogen for plants (33). Increases in vegetative growth could be attributed to the positive effect of humic acid on both plants and soil in increasing microbial activity and enhance soil effectiveness in nutrient uptake as chelating agent and bio-stimulation of plant growth which improves vegetative characteristics, nutritional status, and leaf pigments. These results are in harmony with those obtained by (30, 15, 13, 6) who reported that application of humic acid resulted in increment of plant height, lateral shoot number per plant, leaves number per plant, stem diameter, leaf area, dry weight, and total leaf chlorophyll content comparing with the control. The stimulative effect of humic acid on nutrients concentrations might be explained by other researchers (11, 5) they indicated that humic acid enhanced cell permeability, which in turn made more rapid entry of minerals into root cells and so resulted in higher uptake of plant nutrients.

Furthermore, promotion in nutrients uptake with the addition of humic acid had been reported by various researchers (17, 39) they found that humic acid as an organic fertilizer is very beneficial in increasing plant nutrition and promoted the accumulation of N, P, K in leaves. Results of Boron was observed significantly increased shoot length, shoot diameter, Single leaf area, leaf dry weight, Total Leaf chlorophyll content and Number of leaves per shoot. The reasons behind this could be due to the role of boron has been long recognized as an essential element for plant growth, also boron has an effect on cell wall structure and has a major effect on cell elongation and transfer of sugar (2). These results supported by findings by others (23, 25) who showed that, boron improves necessary compounds for metabolic processes and building organs thereby vegetative growth. Boron foliar spray affected significantly leaf content of boron and this might be due to its role in cell division and cell elongation. Similar finding have been reported by (10, 12, 18, 19, 41).

REFERENCES

1**.** Abd El-Aal, F.S., A.M. Shaheen, A.A. Ahmed and A.R. Mahmoud.2010. "Effect of foliar application of urea and amino plasmas mixtures as antioxidants on growth, yield and characteristics of squash". Res. J.Agric. Biol. Sci., 6: 583–588

2. Abdollahi, M.; S. Eshghi, and E. Tafazoli, (2010). Interaction of paclobutrazol, boron and zinc on vegetative growth, yield and fruit quality of strawberry (Fragaria× ananassa Duch. cv. Selva). J. Biol. Environ. Sci. 4(11): 67-75

3. Abourayya, M.S., N.E. Kaseem, T.S.M. Mahmoud, A.M. Rakha, R.A. Eisa, and O.A. Amin, 2020. Impact of soil application with humic acid and foliar spray of milagro bio-stimulant on vegetative growth and mineral nutrient uptake of Nonpareil almond young trees under Nubaria conditions. Bulletin of the National Research Centre, 44(1), pp.1-8

4. Acar, I.; I. Doran; N. Aslan, and N. Kalkanci 2016. Boron affects the yield and quality of nonirrigated pistachio (*Pistacia vera* L.) trees. Turkish Journal of Agriculture and Forestry. 40(5): 664-670

5. Al-Azzawi, O.S. and I.M. Al-Ibadi, 2017. Effect organic nutrient humic and compound chemical fertilizer in leaves content from elements and total yield cucumber. The Iraqi Journal of Agricultural Science, 48(3), 720

6. Al-Dulaimi, N.H. and Al-Jumaili, M.A., 2017. Effect spraying some micronutrients and add humic acid in traits of roots and leaves content of nutrients in green beans. the iraqi journal of agricultural science, 48(3), 660

7. Alhasawi, A.; Z. Castonguay; N.D. Appanna; C .Auger and V.D. Appanna (2015). Glycine metabolism and anti-oxidative defence mechanisms in *Pseudomonas fluorescens*. Microbiological Research. 171(26-31

8. Al-Rawi, K. M. and A. Khalafalla. 2000. Analysis of Experimental Agriculture Disgen. Dar Al-Kutub for Printing and Publishing. Mosul Univ. (In Arabic

9. Anonymous 2010. Humic and fulvic acids: The black gold of agriculture. Retrieved from www.humintech.com/pdf/humicfulvic acids.pdf

10. Bybordi, A. and M. Malakouti (2009). Effects of N, Zn and B foliar application in increasing fruit set and yield of pistachio in East Azerbaijan. 5th International Symposium on Pistachio and Almond, Turkey. 48(16): 1-4

11. Chen, Y. and T. Aviad 1990. Effect of Humic Substances on Plant Growth. In: Maccarthy, P., Ed., Humic Substances in Soil and Crop Sciences: Selected Readings. American Society of Agronomy and Soil Sciences, Madison, PP:161-186

12. Dutta, P. 2004. Effect of foliar boron application on panicle growth, fruit retention and physico-chemical characters of mango cv. Himsagar. Indian Journal of Horticulture. 61(3): 265-266

13. Eisa R.A, Sh. M. Thanaa, E. K. Nabila, and M.S. Abou Rayya 2016. Foliar application of low-biuret urea and humic acid influences on the growth and leaf mineral composition of Nonpareil almond young trees under South Sinai conditions. Journal of Innovations in Pharmaceuticals and Biological Sciences. JIPBS, Vol 3(1): 143 -153

14. El-Shabasi, M.; S. Mohamed and S. Mahfouz 2005. Effect of foliar spray with amino acids on growth, yield and chemical

composition of garlic plants. The 6th Arabian Conf. for Hort. Ismailia, Egypt

15. Fatma K M Sh, M M .Morsey and Sh M M. Thanaa 2015: Influence of spraying yeast extract and humic acid on fruit maturity stage and storability of "Canino" apricot fruits. International Journal of ChemTech Research; 8 (6): 530 – 543

16. Hassan, H.; S. Sarrwy, and E. Mostafa,2010. Effect of foliar spraying with liquid organic fertilizer, some micronutrients, and gibberellins on leaf mineral content, fruit set, yield, and fruit quality of "Hollywood" plum trees. Agriculture and Biology Journal of North America. 1(4): 638-643

17. Hussien AM, TA. El-Maghraby, HM. Sherif and SA. El-Shal 2005. Effect of liquid organic fertilization techniques on yield and chemical composition of pear and apricot trees grown in sandy soils at South Tahrir province. Fayoum Journal of Agricultural Research and Development; 19(2): 224 – 238

18. Jasrotia, A.; P. Bakshi; V. Wali; B.Bhushan and D.J. Bhat 2014. Influence of girdling and zinc and boron application on growth, quality and leaf nutrient status of olive cv. Frontoio. African Journal of Agricultural Research. 9(18): 1354-1361

19. Keshavarz, K.; K.Vahdati; M. Samar; B. Azadegan, and P.H. Brown (2011). Foliar application of zinc and boron improves walnut vegetative and reproductive growth. HortTechnology. 21(2): 181-186

20. Khayyat, M., E. Tafazoli, S. Eshghi, and S. Rajaee. 2007. Effect of nitrogen, boron, potassium and zinc sprays on yield and fruit quality of date palm. American-Eurasian J. Agr. Environ. Sci. 2:289–296. <http:// citeseerx.ist.psu.edu/view doc / download ? doi = 10.1.1.629.8548 & rep = rep1&type=pdf

21. Kowalczyk, K.; T. Zielony, and M. Gajewski, 2008. Effect of Aminoplant and Asahi on yield and quality of lettuce grown on rockwool. Biostimulators in Modern Agriculture. Vegetable Crops. 6(2): 35-43

22. Ladizinsky G 1999. On the origin of almond. Genetic Resources and Crop Evolution 46:143–147

23. Marschner, H. 1995. Mineral nutrition of higher plants Academic Press New York. Second Edition. New York. Academic Press. pp.841 .

24. Marschner, P. 2012. Marschner's Mineral Nutrition of Higher Plants. 3rd ed. Academic Press, London, UK

25. Mazher, A ;.S. Zaghloul, and A. Yassen, 2006. Impact of boron fertilizer on growth and chemical constituents of Taxodium distichum grown under water regime. World journal of agricultural Sciences. 2(4): 412-420

26. Menninger, E.A. 1977. Edible Nuts of the World, Horticultural Books: Stuart, FL.

27. Mitra, S.K., D.S. Rathore and T.K. Bose, 1991.Temperate Fruits, Allid Publishers, India

28. Molaie, H.; B. Panahi, and A. Tajabadipour 2013. The effect of foliar application of some amino acid compounds on photosynthesis and yield of two commercial cultivars in pistachio orchards of Kerman province in Iran. International Journal of Agriculture and Crop Sciences. 5(23): 2827

29. Mora, V.; E. A. Bacaicoa; G. Zamarreno; Elena; M. Fuentes and J. Maria 2010. Action of humic acid on promotion of cucumber shoot growth involves nitrate-related changes associated with the root-to-shoot distribution of cytokinins, polyamines and mineral nutrients. J. of Plant Phys. 167: 633-642

30. Mustafa NS and SM El-Shazly 2013. Impact of some biostimulant substances on growth parameters of Washington Navel orange trees. Middle East J of Appl Sci. 3:156 –160

31. Nabi, H.S.; N.I.H. Barwary, and A.A.T. , Hussein Moho 2018. Response Of Almond Seedlings Growth To Foliar Spraying Of Amino Plasma, Zinc, Boron And Their Interactions. Chemistry, Sulaimani. University of Sulaimani, 445-452

32. Peryea, F. J. 1994. Boron nutrition in deciduous tree fruit. P. 95 -99. In : A.B. Peterson and R.G. Stevens (eds) Tree fruit nutrition. Good Fruit GrowerYakima, Wash

33. Rahdari, P. and B. Panahi 2001. The evaluation of application amino acids on some quantitative and qualitative of pistachio. 4(131-142

34. Rai, V. 2002. Role of amino acids in plant responses to stresses. Biologia plantarum. 45(4): 481-487.

35. Rieger, M.W. 2001. Online Course: Mark's Fruit Crops site: Almond-*Prunus dulcis* (Mill.), D.A. Webb, Gorgia University, 87-88 and 174-175

36. Saini, H., V. Sourabh, and P. Saini. 2019. Differential responses of Fe, Zn, B, Cu and Mg on growth and quality attributes of fruit crops. J. Pharm. Phytochem. 8(5):1–5. <http://www. phytojournal. com/ archives /2019/vol8issue5/PartA/ 7-3-300-830.pdf

37. Sas, S. 2001. STAT User's Guide for Personal Computers, Release 6.12. SAS Institute Inc. Cary, NC, USA

38. Srivastava, P.C. and U.C. Gupta. 1996. Essential trace elements in crop production, p. 73–173. In:P.C. Srivastava and U.C. Gupta (eds.). Trace elements in crop production. Oxford & IBH Publishing Cop. Pvt. Ltd., New Delhi, India

39. Tahira A, S. Ahmed, M. Ashrsaf, MA. Shadhid, M. Yasin, RM. Balal, MA. Pervez and S. Abbas 2013 .Effect of humic application at different growth stages of Kinnow mandarin (Citrus recticulatablanco) on The basis of physio biochemical and reproductive responses. Academia Journal of Biotechnology; 1(1): 14-20

40. Teixeira, W.F.; E.B. Fagan,; L.H. Soares,; R.C. Umburanas,; K. Reichardt, and D.D. Neto, 2017. Foliar and seed application of amino acids affects the antioxidant metabolism of the soybean crop. Frontiers in plant science. 8(2): 327-329

41. Yadav, V.; P. Singh, and P. Yadav 2013. Effect of foliar fertilization of boron, zinc and iron on fruit growth and yield of low-chill peach cv. Sharbati. International Journal of Scientific and Research Publications. 8(3): 1-6

42. Yildirim, E. 2007. Foliar and soil fertilization of humic acid affect productivity and quality of tomato. Acta Agric. Scand. Sect. B-Soil Plant Sci. 57: 182-186

43. Yua, S.K. and J. Ryan. 2008. Boron toxicity tolerance in crops: A viable alternative to soil amelioration. Crop Sci. 48:854–865.