Response of apricot trees to ground fertilization and foliar spraying

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Abstract . The experiment was conducted in one of the private orchards in the Awfi region , Babylon province, during the season 2018-2019 to show the response of the apricot tree to combinations of fertilization with Qrop Complex and foliar spraying with seaweed extract (Alge-Zone) and their interactions in some chemical and yield traits , which included the content of leaves Of chlorophyll and nutrients (nitrogen, phosphorous, potassium, boron and iron), Fruit weight (g), yield per tree kg.tree -1, percentage of total soluble solids (T.S.S). The randomized complete block design (R.C.B.D) was used with three replicates and the least significant difference (LSD) was used to compare the means at the 0.05 probability level. The results showed that the ground fertilizer with Qrop Complex gave an increase in the studied characteristics, and the foliar spraying with seaweed extract (Alge-Zone) had a positive effect on each of the leaves' content of chlorophyll and nutrients (nitrogen, phosphorous, potassium, boron and iron). Fruit Weight (g),The yield of one tree kg. tree -1, the percentage of total soluble solids (T.S.S).As for the interaction treatment, the ground fertilization with Qrop Complex fertilizer (600 g.tree-1) and foliar spraying with seaweed extract (Alge-Zone) at a concentration of 3 ml. L-1 significantly excelled in giving the best results in the studied traits.

Keywords : apricot , Alge-Zone , foliar spraying , ground fertilization .

1 Introduction

Follow the apricot Prunus armeniaca L. of the Rosaceae family. It is a fruit of the temperate region and the Mediterranean basin, which needs a period of cooling during the autumn and winter seasons to end the dormancy phase in the trees [1]. It was believed that the original home of the apricot is Armenia, but recent studies have shown that it is likely that its origin country is West and Central Asia [2] .It extends eastward to China, and from these areas, it moved to Greece and some European countries, then moved from it to Syria and some North African countries, North America and Australia [3] . The word Apricot dates back to the Greeks, where it was called AL-Praecox, which means early fruit [4]. Apricot is one of the summer fruits of high nutritional value that enters beside fresh consumption in many food industries, the most important of which are juices, jams, and apricot chips, which increase its economic value [5].

Ground feeding with nutrients for agricultural crops is one of the most important foundations of agricultural production and plant life preservation, and providing nutrients in a balanced manner positively affects the growth and development of plants [6] . The compound fertilizer KPN is one of the important nutrients to improve the type of fruits and increase production in fruit trees through ground addition or spraying on trees and within the concentrations recommended by the companies producing it is important. Apricots, such as nitrogen, phosphorous, and potassium, in addition to containing small mineral elements in order to grow well, increase their yield and improve the quality of their fruits [7]. Studies also indicated that the availability of potassium in appropriate quantities plays an important role in improving the quality and productivity of trees. The importance of potassium comes in that it enters into many vital processes in plant cells, and is based on regulating the osmotic pressure of cells [8] . It increases the plant's ability to retain water and contributes to the process of opening and closing plant stomata [9] , as well as its role in stimulating and activating the work of plant enzymes and many other vital processes [10]. seaweed extract is one of the basic materials that can be added or sprayed to the plant and the soil to provide the plant with the basic elements because it contains the necessary macro and micro nutrients, some hormones, and growth regulators such as auxins, gibberellins and cytokinins [11] ,The aim of this research is to know the role of Qrop Complex fertilizer and seaweed extract in improving the quality and quantity of fruits.

2 Materials and methods

The experiment was conducted in the season 2018-2019 in one of the private orchards in the Awfi region / Babylon province to study the effect of fertilization with Qrop Complex (Table 1) and foliar spraying with seaweed extract (Alge-Zone) table and their interactions on some chemical traits and the result such as the content of chlorophyll in leaves (SPAD) and (nitrogen, phosphorous, potassium, boron and iron), average fruit weight (g), yield per tree kg.tree-1, percentage of total soluble solids (TSS)at the age of 6 years and almost homogeneous in length and size and planted with dimensions of 4 * 3 for this cultivar grafted on the seed origin. 48 trees were elected and all the required service operations for trees such as irrigation, fertilization, weeding and control were conducted equally.In this experiment, two factors were used, the first being the ground fertilization with Qrop Complex fertilizer at four levels (control treatment, 200 g.L-1, 400 g.L-1, 600 g.L-1).The second factor is foliar spraying with seaweed extract (Alge-Zone)) at four concentrations (the control treatment, 1 ml.L-1, 2ml.L-1, 3ml.L-1) and accordingly it is a factorial experiment 4*4 = 16 treatments.The Randomized Complete Block Design (RCBD) with three replicates and one tree for the experimental unit, seaweed extract sprays were conducted at two dates after flowering and after flowers set. The results were statistically analyzed using the least significant difference (LSD) to compare the means at the 0.05 probability level [3].

Table (1) The contents of the fertilizer Qrop Complex

N	P	K^{+}	Ca^{++}	Mgo	So3
12	6	24	3	2	14

3 studied traits

1- Chlorophyll content of leaves (SPAD): The chlorophyll concentration was estimated in leaves when they are on trees using the manual scale SPAD meter [12].
2- Nitrogen content of leaves (%): it was estimated using the Microcalcium device [13].
3- The phosphorous content of the leaves (%): using a spectrophotometer according [13], [14].
4- Potassium content of the leaves (%): using a photometer flame as mentioned in [15]
5- Boron content of the leaves (mg.kg-1): it was determined by a Spectrophotometer Absorption Atomic device according to the method of (Chapman and Pratt, 1961) and (Al-Nuaimi, 1999).
6- The iron content of the leaves (mg.kg-1): It was determined by a Spectrophotometer Absorption Atomic device according to the method of [16] , [17]
7- Average weight of the fruit (g): according to the average weight of the fruit, weighing 10 fruits from each experimental unit, using a sensitive electric scale of the Metller type, then extracting the average weight of the fruit, estimated in grams.
8- The yield of one tree kg.tree -1: According to the yield of one tree by multiplying the average weight of one fruit by the number of fruits per tree, estimated in kilograms.
9- Percentage of total soluble solids (T.S.S): The percentage of total soluble solids in fruits was measured by taking a drop of fruit juice for each experimental unit using the Refractometer Hand device directly on the device.

4 Results

4-1 Chlorophyll content (SPAD)

The results in Table (2)showed that there are significant differences between the average chlorophyll content of leaves (SPAD) due to the effect of adding Qrop Complex fertilizer at an average of 600 g. tree-1, which gave the highest average of chlorophyll content of leaves amounted to (51.32 SPAD) compared to the control treatment that gave the lowest average of (35.45 SPAD), As for the foliar spraying treatment with seaweed extract, the concentration of 3 ml.L-1 was excelled on

the rest of the concentration and gave the highest rate of (45.67 SPAD) compared to the control treatment, which gave the lowest average for that trait reached (40.27 SPAD),As for the interaction treatments, the treatment of Qrop Complex fertilizer at a average of 600 g.tree-1 Alge-Zone seaweed extract at a concentration of 3 ml.L-1 was excelled and it gave the highest significant average in the chlorophyll content of leaves, which amounted to (54.67 SPAD) compared to the control that gave) 32.67 SPAD), which is the lowest average for this trait.

Table (2) Effect of ground fertilization and foliar spraying with seaweed extract on Leaf content of chlorophyll (SPAD) for apricot trees cultivar Zaini

ground fertilization	foliar spraying with seaweed extract				average
	A0	A1	A2	A3	
F0	32.63	35.01	36.33	37.81	35.45
F1	38.00	41.45	42.36	42.88	41.17
F2	42.97	44.41	45.34	47.30	45.01
F3	47.49	50.84	52.27	54.67	51.32
average	40.27	42.93	44.08	45.67	
L.S.D0.05	F= 4.920		A= 4.920		F*A= 9.840

4 - 2- Nitrogen content of leaves (%)

The results in Table (3) indicated that the fertilization using Qrop Complex fertilizer at an average of 600 g.tree-1 had a significant effect on the average nitrogen content of the leaves of the apricot trees under study, where these trees excelled and give the highest average for that trait amounted to (1.53%). Compared to the control treatment that gave the lowest average (1.19%).It is also noted from the same table that the trees differ among themselves in the nitrogen content of leaves. The trees sprayed with seaweed extract Alge-Zone at a concentration of 3 ml.L-1 excelled on the rest of the concentrations and gave (1.42%) compared to the control treatment that gave (1.32%). As for the interaction between the treatment of the Qrop Complex fertilizer with the seaweed extract Alge-Zone, the results of the same table indicate the excelled of the interaction trees Qrop Complex fertilizer at an average of 600 g. Tree-1 with seaweed extract at a concentration of 3 ml.L-1 where it gave the highest average for the same trait reached (1.60%) compared to the control treatment which gave the lowest average for this trait reached (1.12%) .

Table (3) Effect of ground fertilization and foliar spraying with seaweed extract on leaves content of Nitrogen (%) for apricot trees cultivar Zaini

ground fertilization	foliar spraying with seaweed extract				average
	A0	A1	A2	A3	
F0	1.12	1.18	1.22	1.27	1.19
F1	1.29	1.33	1.35	1.36	1.33
F2	1.39	1.41	1.43	1.46	1.42
F3	1.47	1.49	1.55	1.60	1.53
average	1.32	1.35	1.39	1.42	
L.S.D0.05	F= 0.161		A= 0.161		F*A= 0.323

4 – 3 The phosphorous content of the leaves (%)

The results in Table (4) indicate that there are significant differences between the average of phosphorous content of leaves (%) due to the fertilizer treatments. The trees were significantly excelled to the fertilizer treatment with Qrop Complex at an average of 600 g.tree-1 on the rest of the treatments (0.42%) in When the control treatment gave the lowest average (0.16%).It is also evident from the same table that the trees showed significant differences among themselves in the

phosphorous content of leaves (%) when sprayed with seaweed extract Alge-Zone. The trees sprayed with a concentration of 3 ml.L-1 excelled in the leaves content of phosphorous (%) and gave (0.33%)) compared to the control treatment that gave the lowest average for this trait (0.26%). The interaction between the Qrop Complex fertilizer treatment with Alge-Zone seaweed extract showed a significant effect on the phosphorous content of the leaves (%). The results of the same table indicate that the Qrop Complex fertilizer treatment at an average of 600 gm. Tree-1 interaction with Alge-Zone seaweed extract. The trees sprayed with a concentration of 3 ml.L-1, which gave the highest rates of (0.47%), excelled compared to the control treatment, which gave the lowest average of (0.12%).

Table (4) Effect of ground fertilization and foliar spraying with seaweed extract on leaves content of phosphorous (%) for apricot trees cultivar Zaini

ground fertilization	foliar spraying with seaweed extract				average
	A0	A1	A2	A3	
F0	0.12	0.16	0.17	0.19	0.16
F1	0.22	0.25	0.27	0.28	0.26
F2	0.30	0.32	0.34	0.37	0.33
F3	0.38	0.40	0.44	0.47	0.42
average	0.26	0.29	0.31	0.33	
L.S.D0.05	F= 2.674		A= 2.674		F*A= 5.349

4 - 4 Potassium content of leaves (%)

Table (5) shows that the ground fertilization with Qrop Complex fertilizer had a significant effect on the potassium content of leaves if the concentration was given 600 g.tree-1 had the highest rate for this trait over the rest of the treatments amounted to (1.54%), while the control treatment gave the lowest average of (1.24%) for apricot trees, As for spraying treatments, the trees treated with Alge-Zone seaweed extract, which were sprayed with a concentration of 3 ml.L-1, excelled, which gave the highest average of (1.54%) compared to the control treatment that gave the lowest average of (1.24%).As for the interaction, the same table indicates that it had a significant effect on the potassium content of leaves, as it reached the highest average of potassium content in leaves when treated with Qrop Complex fertilizer at a average of 600 g. tree-1 interaction with seaweed extract Alge-Zone. The trees that were fertilized with Qrop Complex at a concentration of 600 g. Tree-1 interaction with spraying seaweed extract at a concentration of 3 ml.L-1, which gave the highest average of (1.44%) compared to the control treatment, which gave the lowest average for that trait amounted to (1.09%).

Table (5) Effect of ground fertilization and foliar spraying with seaweed extract on Potassium content of leaves (%) for apricot trees cultivar Zaini

ground fertilization	foliar spraying with seaweed extract				average
	A0	A1	A2	A3	
F0	1.09	1.26	1.29	1.31	1.24
F1	1.33	1.35	1.36	1.39	1.36
F2	1.42	1.43	1.45	1.47	1.44
F3	1.48	1.52	1.56	1.59	1.54
average	1.33	1.39	1.42	1.44	
L.S.D0.05	F= 0.186		A= 0.186		F*A= 0.382

4 – 5 Boron content of leaves (mg.kg^{-1}):

The results in Table (6) showed significant differences between the average boron content of leaves for apricot trees, cultivar Zaini under study due to the effect of adding high-potassium fertilizer, where the trees differed significantly and excelled among trees treated with Qrop Complex at a concentration of 600 g.tree-1 and Which gave the highest average of boron content of leaves (48.04 mg.kg-1) while the control treatment gave (30.88 mg.kg-1). It is noted from the same

table that the trees under study differ among themselves in their effect on the boron content of leaves when sprayed with seaweed extract. The trees sprayed with a concentration of 3 ml.L-1 of Alge-Zone excelled and gave the highest average of (41.82 mg.kg-1). Where, the untreated trees gave the lowest average for this trait, which was (37.48 mg.kg-1). The interaction between the fertilizer treatment Qrop Complex and Alge-Zone seaweed extract significantly affected the boron content of the leaves as indicated in the same table.The highest average of boron content in leaves was with trees treated with Qrop Complex fertilizer at a concentration of 600 g.tree-1 with foliar spraying with seaweed extract Alge-Zone at a concentration of 3 ml.L-1 which gave (50.30 mg.kg-1) When the control treatment gave the lowest average of boron content of the leaves was (28.61 mg.kg-1).

Table (6) Effect of ground fertilization and foliar spraying with seaweed extract on Boron content of leaves (mg.kg-1) for apricot trees cultivar Zaini

ground fertilization	foliar spraying with seaweed extract				average
	A0	A1	A2	A3	
F0	28.61	29.18	31.96	33.75	30.88
F1	34.72	35.11	36.96	38.45	36.31
F2	39.73	42.73	43.53	44.77	42.69
F3	46.86	47.20	47.80	50.30	48.04
average	37.48	38.56	40.06	41.82	
L.S.D0.05	F= 9.838		A= 9.838		F*A= 19.676

4 – 6 Iron content of leaves (mg.kg-1):

The results in Table (7) indicate that there are significant differences in the average of the iron content of leaves due to the effect of the ground addition of the fertilizer Qrop Complex.The trees were significantly excelled with the fertilizer at a concentration of 600 g. tree-1.As shown in Table (7), apricot trees varied among themselves in the average iron content of leaves when sprayed with seaweed extract, where the concentration of 3 ml.L-1 gave the highest average for this trait amounted to (231.18 mg.kg-1), while the control treatment (without spraying) the lowest average for the same trait (216.34 mg.kg-1). The interaction between the ground addition of Qrop Complex and seaweed extract showed a clear effect on the iron content of the leaves. Trees treated with fertilizer at a concentration of 600 g. tree-1 interfering with seaweed extract at a concentration of 3 ml. L-1, was excelled and gave (251.67 mg.kg-1) compared to the control treatment, which gave the lowest average for the same trait amounted to (185.00 mg. kg- 1) .

Table (7) Effect of ground fertilization and foliar spraying with seaweed extract on Iron content in the leaves (mg.kg-1) for apricot trees cultivar Zaini

ground fertilization	foliar spraying with seaweed extract				average
	A0	A1	A2	A3	
F0	185.00	190.00	199.00	208.33	195.58
F1	211.67	217.67	222.00	226.00	219.34
F2	227.67	231.67	234.00	238.67	233.00
F3	241.00	246.67	248.67	251.67	247.00
average	216.34	221.50	225.92	231.18	
L.S.D0.05	F= 2.674		A= 2.674		F*A= 5.349

4 – 7 Fruit weight (g)

The results in Table (8) indicated that the fertilization using a high potassium fertilizer Qrop Complex at an average of 600 g. tree-1 had a significant effect on the fruit weight of the apricot trees, cultivar Zaini, where these trees excelled and give the highest average of that trait amounted to (16.14 g) compared to control treatment, which gave the lowest average (11.97 g).It is also noted from the table that the trees differ among them in the weight of the fruit. The trees sprayed with seaweed extract Alge-Zone at a concentration of 3 ml.L-1 excelled on the rest of the concentrations and gave

the highest average of (14.66 g) compared to the control treatment, which gave the lowest average for the same trait. (13.48 g) . As for the interaction between the treatment of the Qrop Complex fertilizer with the seaweed extract Alge-Zone, the results of the table indicate the significance of the apricot trees with the soil fertilizer at an average of 600 g. Tree-1 interaction with the seaweed extract at a concentration of 3 ml.L-1, which gave the highest average for the same trait. (16.69 g) compared to the control treatment, which gave the lowest average for this trait amounted to (11.18 g).

Table (8) Effect of ground fertilization and foliar spraying with seaweed extract on Fruit weight (g) for apricot trees cultivar Zaini

ground fertilization	foliar spraying with seaweed extract				average
	A0	A1	A2	A3	
F0	11.18	12.02	12.15	12.51	11.97
F1	12.94	13.04	13.68	13.88	13.39
F2	14.20	14.74	15.01	15.30	14.81
F3	15.61	15.93	16.06	16.96	16.14
average	13.48	13.93	14.23	14.66	
L.S.D0.05	F= 1.771		A= 1.771		F*A= 3.543

4 – 8 The yield of one tree (kg^{-1}):.

The results in Table (9) showed differences between the yield average of one tree for apricot trees, cultivar Zaini under study due to the effect of adding this fertilizer.The trees differed among them and the excelled of the trees treated with Qrop Complex fertilizer at a concentration of 600 g. Tree-1, which gave the highest average yield per tree (15.05 tree .kg-1), while the control treatment gave the lowest average for the same trait amounted to (11.78 tree .kg-1).It is noted from the same table that the trees under study differ among them in their effect on the yield of one tree when sprayed with seaweed extract. The trees sprayed with a concentration of 3 ml.L-1 of Alge-Zone excelled and gave the highest average of (13.95 tree .kg-1).While the untreated trees gave the lowest average for that trait (12.88 tree .kg-1), the interaction between the ground fertilizer treatment with Qrop Complex and the seaweed extract Alge-Zone affected the yield of one tree. As indicated in the same table, the highest average of yield per tree was with trees treated with Qrop Complex fertilizer at a concentration of 600 g.tree-1 interaction with foliar spraying with seaweed extract Alge-Zone at a concentration of 3 ml.L-1 which gave (15.77 tree .kg-1) Where, the control treatment gave the lowest average for this trait which was (10.65 tree .kg-1).

Table (9) Effect of ground fertilization and foliar spraying with seaweed extract on the Tree yield (kg^{-1}) for apricot trees cultivar Zaini

ground fertilization	foliar spraying with seaweed extract				average
	A0	A1	A2	A3	
F0	10.65	11.84	12.10	12.51	11.78
F1	12.77	12.87	13.02	13.23	12.97
F2	13.50	13.74	14.01	14.30	13.89
F3	14.59	14.84	15.01	15.77	15.05
average	12.88	13.32	13.54	13.95	
L.S.D0.05	F= 1.902		A= 1.902		F*A= 3.804

4 – 9 Percentage of total soluble solids(T.S.S):.

The results in Table (10) indicated that the fertilization using Qrop Complex fertilizer at an average of 600 g.tree-1 had a significant effect on the percentage of total soluble solids (TSS) for the apricot trees under study, as these trees excelled to give the highest average for that trait reached (15.29%) compared to the control treatment that gave the lowest average (13.41%).It is also noted from the same table that the trees differ among them in the percentage of total soluble solids (TSS), where the trees sprayed with seaweed extract Alge-Zone at a concentration of 3 ml.L-1 outperformed the rest of the concentrations and gave (14.69%) compared to the control that gave 14.13%). As for the interaction between the treatment of the Qrop Complex fertilizer with the seaweed extract Alge-Zone, the results of the same table indicate the significance of the trees that were fertilized with the fertilizer Qrop Complex at an average of 600 gm. The highest average in the percentage of total soluble solids (TSS) amounted to (15.66%) compared to the control treatment, which gave the lowest average for this trait amounted to (13.04%).

Table (10) Effect of ground fertilization and foliar spraying with seaweed extract on the percentage of total soluble solids (T.S.S) for apricot trees cultivar Zaini

ground fertilization	foliar spraying with seaweed extract				average
	A0	A1	A2	A3	
F0	13.04	13.29	13.57	13.74	13.41
F1	13.90	14.07	14.25	14.38	14.15
F2	14.57	14.63	14.72	14.96	14.72
F3	15.04	15.17	15.27	15.66	15.29
average	14.13	14.29	14.45	14.69	
L.S.D0.05	F= 1.428		A= 1.428		F*A= 2.857

5 Discussion

5 -1 Effect of ground fertilization on the leaves content of chlorophyll and mineral elements (N, P, K, B, Fe).

Tables (2, 3, 4, 5, 6, 7) show the significantly of trees fertilized with this fertilizer on the control treatment (without adding). The reason for the increase in this trait may be due to the fact that this fertilizer contains nutrients necessary for growth, especially potassium, which works to stimulate enzymes related to physiological processes such as photosynthesis. It also helps in the movement and transfer of food manufactured in the leaves to other plant tissues, which increased the manufacture of food manufactured in the leaves as a result of containing good quantities of major elements, which increased the content of the leaves of chlorophyll and mineral elements, as the increase of these elements in the plant as a result of processing and absorption from before the plant [18].

5 - 2 The effect of ground fertilization on the weight of the fruit, the yield of one tree, and the percentage of total soluble solids:.

It is evident from the results presented in the tables (8, 9, 10), and the reason for this may be due to the improvement of the vegetative growth of trees and thus the increase in the processed foodstuffs that grow leaves and collect them in the fruits in an increase in the yield, which led to an increase in the number of fruits remaining on the tree at the harvest, which was reflected positively on the yield of trees as a result of processing nutrients and increasing their absorption from the soil, which led to an increase in the trees' benefit from them in improving their vegetative and fruit growth .

5 - 3 Effect of seaweed extract on chlorophyll content and mineral elements (N, P, K, B, Fe) in leaves.

Foliar spraying with seaweed extract had a clear effect on the traits under study (Tables 2, 3, 4, 5, 6, 7) that these compounds increase the growth of the vegetative system, increase the quantity of

yield, improve its quality, delay the aging of fruits and increase plant resistance to biotic and abiotic stress. [19] .These extracts also have a great role as primary products of organic materials, and synthetic materials such as seaweed extract cells consist of many important compounds such as sugars, amino acids, RNA, DNA and enzymes, as well as proteins [20] of important compounds such as vitamins and minerals, and thus have an important role in raising the efficiency of the photosynthesis process, increasing the manufactured materials in the leaves and increasing the leaves' mineral content [21].

5 -4 Effect of seaweed extract on fruit weight, yield per tree and percentage of total soluble solids:

It is evident from the results presented in tables (8,9,10) to the increase that occurred when spraying with seaweed extract. The reason for this may be due to the improvement of the vegetative growth of trees and thus the increase in processed foodstuffs that grow leaves and combine them with young fruits in an increase in yield.Which led to an increase in the number of fruits remaining on the tree when harvesting, which was positively reflected on the yield of trees as a result of processing nutrients and increasing their absorption from the soil, which led to an increase in the trees' benefit from them in improving their vegetative and fruit growth. The quality of orange fruits with an increase in the percentage of sugars in them when treating trees with seaweed extracts [22]. Also, these extracts increase the efficiency of nutrient absorption, increase the processes of photosynthesis and respiration, and these compounds may act as an antioxidant because they contain alpha-tocopherol, beta-carotene, niacin, thymine and ascorbic acid, and through their role in increasing the activity of many enzymes [20] . As for the treatment of the interaction between the Qrop Complex fertilizer and the seaweed extract, its effect was clear in giving the best results. The reason may be due to the result of their interaction, thus giving a clear increase in the studied characteristics. The reason may be due to the reasons mentioned previously.

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