

Effect of cultivation system, fertilization with calcium and organic nutrient (Tecamin Tex-fruit) on growth, yield and quality of two lettuce cultivars *Lactuca sativa* L.

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ABSTRACT

The experiment was carried out at vegetables field of Horticulture and landscape Design department. College of Agriculture and Forestry. University of Mosul during the growing season 2021-2022 to study the physiological effect of some treatments on vegetative growth, quantitative and qualitative yield, quality traits, physiological damages, leaves content of nutrients, and economic feasibility of lettuce plants. The experiment included a study of the effect of three different factors, the first: Cultivation system (growing lettuce plants under the conditions of the unheated plastic house and cultivation in the open field), as for the second factor: It included the type of fertilizer, as this factor included two types of fertilizers Calcium fertilizer with two concentrations of 150 and 300 mg L⁻¹ and the organic nutrient (Tecamin Tex-fruit) with two concentrations of 3 and 6 ml L⁻¹ in addition to the comparison treatment, while the third factor included two lettuce cultivars (Rawaa and Fajr). The results were analyzed statistically according to Dunkin's multiple range test at the probability level of 0.05%. The most important results can be summarized as follows: The plants grown in the open field were significantly superior to the plants grown inside the plastic house in the total head weight, the total yield per square meter, the total yield of the experimental unit, and the plants treated with both concentrations of the organic nutrient Tecamin Tex-fruit 3 and 6 ml L⁻¹ achieved significant increase in all studied yield traits. plants Rawa cultivar were significantly superior to Fajr cultivar plants in all quantitative yield traits.

1. Introduction

Lettuce with the English name Lettuce and the scientific name *Lactuca sativa* L. It is the most important vegetable crop that follows the Compositae family, or the Sunflower Family, which is known scientifically as Asteraceae (Hassan, 2003). The compound family is one of the largest families in the plant kingdom, as it includes about 800 species, and about twenty thousand species, most of which are annual or perennial herbaceous plants and some are shrubby. Each 100 gm of lettuce leaves contains the following nutritional components: 94 gm moisture, 18 calories, 1.3 gm protein, 0.3 gm fat, 3.5 gm carbohydrates, 0.7 gm fiber, 0.9 ash, 68 mg calcium, 25 mg phosphorus, 1.4 mg iron, 9 mg sodium, 264 mg potassium, 11 mg magnesium, 19 IU vitamin A, 0.05 mg thiamine, 0.08 mg riboflavin, 0.4 mg niacin, and 18 mg ascorbic acid (Kim et al. 2016). As for its medicinal value, it lies in the use of lettuce leaves in the treatment of chronic constipation due to the fact that they contain cellulosic fibers that assist the intestines in its circular movement and help in hydration of the body and in diuresis, especially for people with gout and urolithiasis (Al-Qabbani, 1978). It is an important source of many antioxidants, such as phenols, and these protect against cancer and heart diseases (Lister, 2003). It is used to treat skin infections and burn pain, as fresh leaves are used in the form of topical plasters to relieve pain and remove tumors and infections (Mohamed Atta, 2014). The statistics of the Central Organization for Statistics and Information in Iraq for the year 2021 indicate that the cultivated area for this crop amounted to 16571 hectares, with a productivity rate of 27.676 tons hectare⁻¹ (Central Statistical Organization, 2021), despite this, we find that the production rates for this crop and for many countries of the world have exceeded these values necessitate a study of the reasons and an attempt to raise the productivity of this crop, as raising the productivity can be achieved by using several techniques in agriculture, including cultivation in different systems, in addition to the use of calcium and organic nutrients, and choosing the appropriate variety. Calcium is one of the most important nutrients affecting the growth and development of plants, and it is one of the slow-moving elements and the transition between cells. This problem can be overcome by spraying it on the

vegetative system to reduce the symptoms of its deficiency and increase its concentration in the leaves according to the concentration and the number of times and times of spraying (Harper et al., 2004). Calcium has many physiological functions as it contributes to the formation of the cell wall through its entry into the composition of the middle lamina that connects the plant cells to each other, as lactic acid interacts with calcium to form insoluble calcium flakes that work with magnesium flakes in the formation of the cell wall (Abdoul, 1988). It plays an essential role in the permeability of plasma membranes, as well as increases the plant's ability to metabolize carbon dioxide, absorb and benefit from many nutrients, thus increasing cell tolerance to environmental stresses. It also plays an important role in activating many enzymes related to plant growth and development (Palta, 2010 and Amershi et al., 2014). Recently, interest in the quality of food products and food safety issues has increased, and the phenomenon of food, soil, and water contamination has been exacerbated by the residues of fertilizers, pesticides, and others. The issue of clean plant production, free of residual effects of pesticides and mineral fertilizers, has emerged. Interest in organic nutrition has increased, and calls have emerged to abandon fertilizers, chemical pesticides, and all industrial additives (Hussein et al. 2009). The addition of organic nutrients, spraying on the leaves or watering to the soil, is efficient in making food in plant tissues in the processes of carbon metabolism (Peuke et al, 1998). Adding it can fill an important part of the plant's need for nutrients. Also, the organic compounds dissolved in the water have an effect on the development and growth of the plant, because they contain many compounds such as sugars, proteins, amino acids, and humic organic acids. All of these compounds contribute directly or indirectly. In plant growth and development, they are either encouraging growth by enzymatic or hormonal action, as they contain elements needed by the plant to perform its various functions, or they affect increasing the readiness of the elements originally present in the soil or added to it, leading to increased production and improvement of its quality (Al-Fartousi, 2003). Lettuce has many varieties, and each variety has its own characteristics in terms of production, quantity and quality. The local varieties and the majority of foreign varieties grown in Iraq belong to the lettuce group with elongated heads (Cos or Romaine). Varieties with good specifications and high productivity are among the most important factors that determine productivity (Taha, 2007), as the varieties are generally governed by genetic and environmental overlap, so the genetic nature of the cultivated variety greatly affects the quantity and quality of the yield (Kumar et al, 2000) and the direction of recent research it has focused on raising the efficiency of agricultural production, by using high-yielding vegetable varieties, whether they are pure or hybrid varieties. Lettuce varieties vary in terms of productivity per unit area, depending on their genetic ability and the prevailing conditions during the period of growth and production. One of the economics of production is to provide varieties that are characterized by high productivity. And with good quality specifications that must be accepted by the consumer (Ibrahim, 2007). And because of the importance of the plant from the nutritional, economic and medical point of view, and the importance of the cultivation system, organic nutrients, calcium element, and varieties in the growth, yield, and quality of lettuce, we decided to conduct this study, with the aim of it: A comparison between two lettuce cultivation systems, which are cultivation in unheated plastic houses and open field in order to find the most efficient system whose effect is reflected in increasing the quantitative yield indicators. Improving the quantitative yield of plants by foliar spraying with different concentrations of calcium and the organic nutrient Tecamin Tex-fruit. Finding the best concentration to which lettuce plants respond to calcium and the organic nutrient Tecamin Tex-fruit in order to raise and improve production.

2. Methodology

The experiment was carried out in the vegetable field of the Department of Horticulture and Landscape Design / College of Agriculture and Forestry/ University of Mosul, during the growing season 2021-2022. The experimental land was divided into experimental units, the soil was divided into three sectors with 3 repetitions in each system with a length of 1.5 m and a width of 1 m. Thus, the area of the experimental unit was 1.5 m², and there were three lines for cultivation within one terrace, the distance between one line and another was 35 cm, and the distance between one plant and another 30 cm, with 15 plants/experimental unit, i.e. 45 plants per treatment, a distance of 50 cm was left between the experimental units as a buffer to prevent confusion between treatments. Then drip irrigation pipes were installed, which is the irrigation system used in the experiment. In the study, the seeds of two lettuce cultivars (Rawaa and Fajr) were used in the study. The seeds were planted on (9/11/2021) in plastic germination trays consisting of (50) cells using the peat moss material as a culture medium, and after the seedlings reached the three-four stage. real leaves planted in the morning with complete care while keeping the house moss around the roots during seedlings and preserving soil moisture. The experiment was carried out using a Factorial Experiment within split plots in a Completely Randomized Design (R.C.B.D). The plants were treated with calcium and an organic nutrient during three stages of plant growth: the first, ten days after seeding, the second, and the third, with an interval of fifteen days between one spraying and another. Thus, the experiment included 20 treatments (2 * 2 * 5), where the cultivation system was placed in the main plots, and the compatibility between the cultivars and spraying with calcium and organic nutrients in the sub plots was established, and each treatment was repeated three times. The results were analyzed statistically according to (SAS,1017) program. Studied traits: 1- Total head weight (gm head⁻¹) 2- Weight of the marketing head (gm head⁻¹) 3- Total yield per square meter (kg m²) 4- Marketing yield per square meter (kg m²)

3. Results and Discussion

The data of Table (1) indicate in the effect of the cultivation system for the total head weight that the plants grown in the open field were significantly superior to the plants grown in the plastic house with an increase of 7.29%, and the plants treated with both concentrations of calcium and the organic nutrient Tecamin tex-fruit were significantly superior in this trait compared the comparison treatment, which gave plants the lowest value in this trait amounting to 566.63 gm head-1. Plants of cultivar Rawaa were significantly superior to plants of cultivar Fajr in average of total head weight. As for the data of the binary interaction between the cultivation system and the type of fertilizer, the results indicate that the plants grown in the open field and treated with a concentration of 3 ml L-1 of the organic nutrient Tecamin tex-fruit were significantly superior to all the interaction treatments except for the two interaction treatments between the plants grown in the open field and under a concentration of calcium 300 mg L-1 and a concentration of 6 ml L-1 of the organic nutrient Tecamin tex-fruit, as the total head weight of the superior treatment was 763.33 g head-1, while the lowest value for this trait was recorded as 535.17 g head-1 in plants grown in the open field for the comparison treatment. As for the results of the binary interaction between the cultivation system and the cultivars, the results of the table indicate that the best significant value in the total head weight amounted to 689.53 g head-1, which was reached in the case of the open field cultivation system for Rawaa cultivars, and it differed significantly only on the treatment of the bilateral interaction between Plants grown in the plastic house in the case of cultivar Fajr, whose plants gave the lowest total head weight amounted to 607.27 g head-1. In the binary interaction between the type of fertilizer and the cultivars, we note that the plants of the Rawaa cultivar, when using the organic nutrient at a concentration of 3 ml L-1, had a maximum total head weight of 765.73 g head-1, while the lowest value of the total head weight was recorded in this overlap when compared to treatment For plants of Fajr cultivar, it amounted to 560.20 g head-1. The results of the triple interaction between the cultivation system, fertilizer type, and cultivars show that the highest total head weight was reached in plants grown in the open field of Rawaa cultivar when using a concentration of 3 ml L-1 of the organic nutrient Tecamin tex-fruit reached 863.33 g head-1, and the lowest head weight recorded in plants grown in the open field when the comparison treatment of Rawaa cultivar was 527.33 g head-1.

Table 1: Effect of the cultivation system, calcium, organic nutrients, cultivars and their interactions on total head weight(gm haed-1)

Cultivation system	Fertilizer type and concentration	Cultivars		Cultivation system X Fertilizer type	Average effect of cultivation system
		Rawaa	Fajr		
Plastic house	Control	618.80 c-f	577.40 d-f	598.10 cd	630.73 b
	Calcium 150 mg.L-1	680.00 b-e	627.87 c-f	653.93 bc	
	Calcium 300 mg.L-1	662.67 b-f	597.67 c-f	630.17 b-d	
	Tecamin Tex-Fruit 3 ml.L-1	668.13 b-e	630.67 c-f	649.40 bc	
	Tecamin Tex-Fruit 6 ml.L-1	641.33 c-f	602.73 c-f	622.03 cd	
Open field	Control	527.33 f	543.00 ef	535.17 d	676.73 a
	Calcium 150 mg.L-1	598.67 c-f	705.67 b-d	652.17 bc	
	Calcium 300 mg.L-1	666.33 b-e	733.33 bc	699.83 a-c	
	Tecamin Tex-Fruit 3 ml.L-1	863.33 a	663.33 b-f	763.33 a	

	Tecamin Tex-Fruit 6 ml.L-1	792.00 ab	674.33 b-e	733.17 ab	
Cultivation system X Cultivars	Plastic house	654.19 a	607.27 b	Average effect of fertilizer type	
	Open field	689.53 a	663.93 a		
Fertilizer type X Cultivars	Control	573.07 d	560.20 d	566.63 b	
	Calcium 150 mg.L-1	639.33 c	666.77 bc	653.05 a	
	Calcium 300 mg.L-1	664.50 bc	665.50 bc	665.00 a	
	Tecamin Tex-Fruit 3 ml.L-1	765.73 a	647.00 c	706.37 a	
	Tecamin Tex-Fruit 6 ml.L-1	716.67 ab	638.53 c	677.60 a	
Average effect of cultivars		671.86 a	635.60 b		

Averages that share the same letter for each factor and each interaction do not differ significantly between them according to Duncan's polynomial test at the probability level (0.05).

Table (2) shows that there is no significant difference between the plants growing inside the unheated plastic house and the open field in the weight of the marketing head. As for the effect of the type of fertilizer, the results indicate that the use of both concentrations of each of calcium and the organic nutrient Tecamin tex-fruit led to a significant increase in this trait compared with the comparison treatment, and it is noted from the results of the table that the plants of the cultivar Rawaa were significantly superior to the plants of the cultivar Fajr in this trait. In the effect of the binary interaction between the cultivation system and the type of fertilizer, it is noted that the highest weight of the marketing head was obtained in the case of plants grown in the open field and sprayed with a concentration of 3 ml L-1 of the organic nutrient. As for the results of the binary interaction between the cultivation system and the cultivars, the results of the table indicate that the highest significant value in the marketing head weight amounted to 582.32 g head-1, which was reached in the case of the binary interaction between the plants grown in the plastic house of the Rawaa cultivar. Significant effects appeared in the case of the binary interaction between fertilizer type and cultivars, as the plants of Rawaa cultivar, when using the organic nutrient Tecamin tex-fruit at a concentration of 3 ml L-1, had the marketing head weight reaching its maximum value of 672.84 g head-1, while the lowest value appeared. For this characteristic when the comparison treatment in plants of the cultivar Rawaa, where the value of the marketing head weight in this overlap was 483.07 gm head-1. The results of the triple interaction between the cultivation system, fertilizer type, and cultivars show that the highest marketable head weight was recorded in plants grown in the open field of Rawaa cultivar when using a concentration of 3 ml L-1 of the organic nutrient Tecamin tex-fruit, where the marketable head weight of this treatment was 755.82 gm head-1, while the lowest marketing head weight was recorded during the comparison treatment for plants grown in the open field of cultivar Rawaa, where its value was 417.13 gm head-1.

Table 2: Effect of the cultivation system, calcium, organic nutrients, cultivars and their interactions on marketable head weight(gm haed-1)

Cultivation system	Fertilizer type and concentration	Cultivars		Cultivation system X Fertilizer type	Average effect of cultivation system
		Rawaa	Fajr		
Plastic house	Control	549.00 b-d	520.73 c-e	534.87 a	563.09 a
	Calcium 150 mg.L-1	598.53 bc	563.13 b-d	580.83 a	
	Calcium 300 mg.L-1	594.33 bc	534.33 b-e	564.33 a	
	Tecamin Tex-Fruit 3 ml.L-1	589.87 bc	561.40 b-d	575.63 a	

	Tecamin Tex-Fruit 6 ml.L-1	579.87 bc	539.73 b-e	559.80 a	
Open field	Control	417.13 e	448.43 d-e	432.78 b	553.33 a
	Calcium 150 mg.L-1	510.18 c-e	581.73 bc	545.96 a	
	Calcium 300 mg.L-1	556.90 b-d	577.60 bc	567.25 a	
	Tecamin Tex-Fruit 3 ml.L-1	755.82 a	476.27 c-e	616.04 a	
	Tecamin Tex-Fruit 6 ml.L-1	661.15 ab	548.07 b-d	604.61 a	
Cultivation system X Cultivars	Plastic house	582.32 a	543.87 ab	Average effect of fertilizer type	
	Open field	580.24 a	526.42 b		
Fertilizer type X Cultivars	Control	483.07 d	484.58 d	483.82 b	
	Calcium 150 mg.L-1	554.36 bc	572.43 bc	563.40 a	
	Calcium 300 mg.L-1	575.62 bc	555.97 bc	565.79 a	
	Tecamin Tex-Fruit 3 ml.L-1	672.84 a	518.83 cd	595.84 a	
	Tecamin Tex-Fruit 6 ml.L-1	620.51 ab	543.90 cd	582.20 a	
Average effect of cultivars		581.28 a	535.14 b		

Averages that share the same letter for each factor and each interaction do not differ significantly between them according to Duncan's polynomial test at the probability level (0.05).

The data of Table (3) on the effect of the cultivation system on the total yield per square meter indicate that the plants grown in the open field were significantly superior to the plants grown in the plastic house with an increase of 7.29%, and the plants treated with both concentrations of calcium and the organic nutrient Tecamin tex-fruit excelled in these the trait was significantly superior to the comparison treatment, and it is noted from the results of the table that the plants of the Rawaa cultivar are significantly superior to the plants of the cultivar Fajr in this trait. In the case of the binary interaction between the cultivation system and the type of fertilizer, it is noted that the highest total yield per square meter was recorded in the plants grown in the open field and treated with a concentration of 3 ml L-1 of the organic nutrient Tecamin tex-fruit amounted to 7.633 kg m², while the lowest value of the total yield amounted to 5.352 kg m², it was recorded when the comparison treatment of plants grown in the open field. As for the results of the binary interaction between the cultivation system and the cultivars, the results of the table indicate that the best significant value in the total yield per square meter amounted to 6.895 kg m², which was reached in the case of plants grown in the open field of the Rawaa cultivar. In the results of the binary interaction between the type of fertilizer and the cultivars, we note that the plants of the Rawaa cultivar, when using the organic nutrient Tecamin tex-fruit at a concentration of 3 ml L-1, reached the maximum value of the total yield per square meter of 7.657 kg m², while the lowest value of the total yield was recorded in this binary overlap when the comparison treatment of Fajr plants, in which the total yield was 5.602 kg m². Through the results of the triple interaction between the three factors of the study, it is noted that the highest total yield per square meter was recorded in plants grown in the open field of cultivar Rawaa and treated with a concentration of 3 ml L-1 of the organic nutrient Tecamin tex-fruit amounted to 8.633 kg m², and this treatment was significantly superior to all other overlap treatments with the exception of the same treatment of triple interaction when using the organic nutrient Tecamin tex-

fruit at a concentration of 6 ml L-1, while the lowest total yield per square meter was reached in the case of plants grown in the open field when the comparison treatment of Rawaa cultivar, with a value of 5.273 kg m².

Table 3: Effect of the cultivation system, calcium, organic nutrients, cultivars and their interactions on total yield per square meter (kg m²)

Cultivation system	Fertilizer type and concentration	Cultivars		Cultivation system X Fertilizer type	Average effect of cultivation system
		Rawaa	Fajr		
Plastic house	Control	6.188 c-f	5.774 d-f	5.981 cd	6.307 b
	Calcium 150 mg.L-1	6.800 b-e	6.279 c-f	6.539 bc	
	Calcium 300 mg.L-1	6.627 b-f	5.977 c-f	6.302 b-d	
	Tecamin Tex-Fruit 3 ml.L-1	6.681 b-e	6.307 c-f	6.494 bc	
	Tecamin Tex-Fruit 6 ml.L-1	6.413 c-f	6.027 c-f	6.220 cd	
Open field	Control	5.273 f	5.430 ef	5.352 d	6.767 a
	Calcium 150 mg.L-1	5.987 c-f	7.057 b-d	6.522 bc	
	Calcium 300 mg.L-1	6.663 b-e	7.333 bc	6.998 a-c	
	Tecamin Tex-Fruit 3 ml.L-1	8.633 a	6.633 b-f	7.633 a	
	Tecamin Tex-Fruit 6 ml.L-1	7.920 ab	6.743 b-e	7.332 ab	
Cultivation system X Cultivars	Plastic house	6.541 a	6.073 b	Average effect of fertilizer type	
	Open field	6.895 a	6.639 a		
Fertilizer type X Cultivars	Control	5.731 d	5.602 d	5.667 b	
	Calcium 150 mg.L-1	6.393 c	6.668 bc	6.531 a	
	Calcium 300 mg.L-1	6.645 bc	6.655 bc	6.650 a	
	Tecamin Tex-Fruit 3 ml.L-1	7.657 a	6.470 c	7.064 a	
	6 Tecamin Tex-Fruit ml.L-1	7.167 ab	6.385 c	6.776 a	
Average effect of cultivars		6.718 a	6.356 b		

Averages that share the same letter for each factor and each interaction do not differ significantly between them according to Duncan's polynomial test at the probability level (0.05). 07503165575

Table (4) shows in the effect of the cultivation system that there is no significant difference between the two cultivation systems in the marketing yield per square meter. As for the effect of the type of fertilizer, the results indicate that the use of both concentrations of calcium and the organic nutrient (150 and 300 mg L-1) and (3) And 6 ml L-1), respectively, for each type of fertilizer led to a significant increase in this trait compared to the comparison treatment, and the superior treatments did not show

any significant difference between them in this trait. This characteristic, with an increase rate of 8.59%, as the value of this characteristic was 5.812 and 5.352 kg m², respectively, for each variety. In the results of the binary interaction between the cultivation system and the type of fertilizer, it is noted that the highest marketing yield per square meter was reached in the case of plants grown in the open field and treated with a concentration of 3 ml L⁻¹ of the organic nutrient Tecamin tex-fruit amounted to 6.160 kg m², noting that all interaction coefficients the two treatments were significantly superior to the comparison treatment in the open field, and these superior treatments did not differ significantly among themselves in this characteristic. As for the results of the binary interaction between the cultivation system and the cultivars, the results of the table indicate that the highest significant value in the marketing yield per square meter amounted to 5.823 kg m², which was reached in the case of the bilateral interaction between the plants grown in the plastic house in the case of the Rawaa cultivar. The binary interaction between the type of fertilizer and the cultivars led to a significant increase in the market yield per square meter, as it was observed that the plants of the Rawaa cultivar, when using the organic nutrient Tecamin tex-fruit at a concentration of 3 ml L⁻¹, reached the market yield per square meter to its maximum value of 6.728 kg m², while the market yield per square meter reached its maximum value, the market yield per square meter decreased to its lowest value of 4.831 kg m² in the comparative treatment of Rawaa cultivar. The results of the triple interaction between the cultivation system, fertilizer type, and cultivars show that the highest marketing yield per square meter was recorded in the plants grown in the open field and treated with a concentration of 3 ml L⁻¹ of the organic nutrient Tecamin tex-fruit in the case of the cultivar Rawaa amounted to 7.558 kg m². Thus, this interaction treatment outperformed all other treatments related to this overlap except for the treatment of plants grown in the open field and treated with a concentration of 6 ml L⁻¹ of the organic nutrient Tecamin tex-fruit for the same variety, while the lowest marketing yield per square meter amounted to 4.171 kg m² was recorded in the comparison treatment of plants grown in the open field of the cultivar Rawaa.

Table 4: Effect of the cultivation system, calcium, organic nutrients, cultivars and their interactions on marketing yield per square meter (kg m²)

Cultivation system	Fertilizer type and concentration	Cultivars		Cultivation system X Fertilizer type	Average effect of cultivation system
		Rawaa	Fajr		
Plastic house	Control	5.490 b-d	5.207 c-e	5.349 a	5.631 a
	Calcium 150 mg.L-1	5.985 bc	5.631 b-d	5.808 a	
	Calcium 300 mg.L-1	5.943 bc	5.343 b-e	5.643 a	
	Tecamin Tex-Fruit 3 ml.L-1	5.899 bc	5.614 b-d	5.757 a	
	Tecamin Tex-Fruit 6 ml.L-1	5.799 bc	5.397 b-e	5.598 a	
Open field	Control	4.171 e	4.484 de	4.327 b	5.533 a
	Calcium 150 mg.L-1	5.102 c-e	5.817 bc	5.459 a	
	Calcium 300 mg.L-1	5.569 b-d	5.776 bc	5.672 a	
	Tecamin Tex-Fruit 3 ml.L-1	7.558 a	4.7623 c-e	6.160 a	
	Tecamin Tex-Fruit 6 ml.L-1	6.612 ab	5.481 b-d	6.046 a	
Cultivation system X	Plastic house	5.823 a	5.439 ab		

Cultivars	Open field	5.802 a	5.264 b	Average effect of fertilizer type
Fertilizer type X Cultivars	Control	4.831 d	4.846 d	4.839 b
	Calcium 150 mg.L-1	5.544 bc	5.724 bc	5.634 a
	Calcium 300 mg.L-1	5.756 bc	5.559 bc	5.658 a
	Tecamin Tex-Fruit 3 ml.L-1	6.728 a	5.188 cd	5.958 a
	Tecamin Tex-Fruit 6 ml.L-1	6.205 ab	5.439 cd	5.822 a
Average effect of cultivars		5.812 a	5.352 b	

Averages that share the same letter for each factor and each interaction do not differ significantly between them according to Duncan's polynomial test at the probability level (0.05).

The increase achieved in most of the indicators of the quantitative yield of the plants grown in the open field compared to the plants grown inside the plastic house, as a result of the long growth period of the plants grown in the open field and the length of the photoperiod to which the plants grown in the open field were exposed, which increased the efficiency of the foodstuffs manufactured in the leaves represented by wit nutrients during the process of photosynthesis, which is due to the increase in divisions in the cells to keep pace with the processes of growth and development, and thus was reflected in the form of significant increases in the aforementioned quantitative yield indicators. The significant effect of calcium in increasing the characteristics of the quantitative yield indicates the positive role of calcium in increasing the efficiency of photosynthesis (Nakata, 2003), as it has a role in activating many enzymes such as arginine kinase and adenosine triphosphate (Abu Dhahi and Al-Younes, 1988). As well as for its positive role in building cell walls through its association with insoluble pectin and the formation of calcium pectus that increase the rigidity of cell walls (Vander, 1999), which helps in regulating the permeability of membranes to water and nutrients (David, 2007). Calcium also helps in stimulating the formation of proteins by increasing the amount of nitrogen absorbed by the plant and is related to an increase in the uptake of potassium (Al-Nuaimi, 1999). All these roles and physiological effects of calcium, therefore, reflected their impact on improving the characteristics of the aforementioned quantity. The significant increase in yield characteristics when using the organic nutrient concentration Tecamin Tex-Fruit These results are in line with the findings of many researchers who indicated that the use of organic nutrients significantly affects the increase in quantitative and qualitative yield indicators. According to what Ibrahim (2012) mentioned, seaweed extracts as a source of organic nutrition contribute to increasing the moisture content of the plant, which leads to an increase in the efficiency of the photosynthesis process, which leads to greater vital activities, which requires an increase in gas permeability (O₂ and CO₂) that are inseparable in the process of respiration and photosynthesis and thus is reflected The positive effect of these extracts on growth and yield indicators. (Odell, 2003) believes that organic nutrients from different sources contain auxins, amino acids and other plant hormones that stimulate the growth and development of the root and vegetative systems and prevent the oxidation of vitamin (C) and (E) that are found in chloroplasts, which increases the efficiency of the photosynthesis process and the production of carbohydrates. It was also observed through the results that the plants of the Rawaa cultivar were significantly superior to the plants of the cultivar Fajr in all the characteristics of the studied yield. The reason for this may be due to the genetic differences between the two cultivars, since the quantitative and qualitative yield characteristics are controlled by the genetics of the cultivars in the presence of significant differences between the lettuce cultivars in Characteristics of the quantitative and qualitative yield.

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