Response of Strawberry CV. Festival to Culture Media and Foliar Application of Nano and Normal Micronutrients

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Response of Strawberry CV. Festival to Culture Media and Foliar Application of Nano and Normal Micronutrients

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Abstract. The study was done in a greenhouse at the department of Horticulture and Landscape Gardening, College of Agriculture, University of Anbar for the growing season 2019-2020. It was designed to study the effect of the agricultural media and spraying with nano and normal zinc and iron on the traits of flowers and yield of Strawberry (CV. Festival) under the protective environment conditions. Three agricultural media were used for the first factor included: (River soil and Peat moss 3:1), (River soil and "50% Coantail + 50% Alfalfa" 3:1) and (River soil and poultry waste 3:1), presented with symbols (M1, M2, M3), respectively. The second factor consisted of spraying with zinc and iron nano and normal with the following concentrations (normal-Zn 50 mg L^{-1}, nano-Zn 10 and 20 mg L^{-1}, normal-Iron 150 mg L^{-1}, and nano-iron 20 and 40 mg L^{-1}) in addition to the control treatment (distilled water), mentioned as (S0, S1, S2, S3, S4, S5, S6), respectively. The results revealed that planting Strawberry in different media had a significant effect on flower traits and yield especially the media culture (M3) which presented the best results for the traits (number of flowers, percentage of flowers set, number of fruits, weight, length and diameter of fruit, and yield), which reached (34.4 flower $plant^{-1}$, 77.5%, 28.4 fruit $plant^{-1}$, 21.50 g, 4.28 cm, 3.37 cm and 628.1 g $plant^{-1}$). On the other hand, the media culture (M3) caused a reduction in the percentage of the fruits malformation to a minimum value of (14.9%). Spraying with nano-zinc and iron and normal zinc and iron achieved significant effect, especially (S5), that gave the highest values for the traits (number of flowers, percentage of flowers set, number of fruits, weight, length and diameter of fruit, and yield) which were (32.8 flower $plant^{-1}$,76.5%, 25.6 fruit $plant^{-1}$, 21.12 g, 4.20 cm, 3.42 cm, and 554.4 g $plant^{-1}$) respectively. On the other hand, (S5) concentration caused a reduction in the percentage of the fruits malformation to a minimum value of (14.2%). The interaction between the two factors of the study in all of the responses studied. The treatment interaction (M3S5) gave the best results for traits (number of flowers, percentage of flowers set, percentage of the fruits malformation, number of fruits, weight and length of fruit, and yield), which reached (42.0 flower $plant^{-1}$, 83.4%,11.8%, 31.2 fruit $plant^{-1}$, 25.58 g, 4.72 cm and 782.4 g $plant^{-1}$), respectively. On the other hand, the treatment interaction (M2S4) showed the highest value of fruit diameter (3.84 cm).

1. Introduction

Strawberry plant (*Fragaria ananassa* Duch).Belongs to the *Rosaceae* family. It has been cultivated in many western countries, Japan, and several other Mediterranean countries. The total area of grown Strawberry was 395844 Hectare for the year 2019 with a global production rate of 9.2 million Ton for the same year. China is on top of the list with a production rate of 3.72 million tons followed by the United States, Mexico, Egypt, and Turkey [1]. Strawberry is considered relatively a modern practice [2] and it is limited to scientific experiments, several private domestic gardens, and a few farming areas. Its consumption is considered low and most of the consumed strawberry is imported from Syria, Iran, and Turkey [3]. The strawberry plant is featured with a low depth and moderate spreading root system [4]. Strawberry fruit has high nutrition and curative value due to its content of nutrition elements, fibers, vitamins, proteins, carbohydrates, phenols, and other anti-oxidants [5], [6]. The fruits also have protective effects against cardiovascular diseases, cancerous diseases, rise in blood pressure, and other chronic diseases [7-9]. Availability of nutrition for the plant is one of the vital conditions to improve the productivity and growth of strawberries [10]. Therefore, choosing the cultivation medium has a great effect on improving the biological, physical, and chemical traits of soil [11], [12]. The organic matter in the cultivation medium contributes to increasing the availability and readiness of vital elements for growth and production, in addition to increasing soil aeration, water capacity, regulating soil temperature, and increase the activity of living organisms [13-16].

Strawberry plant is considered gluttony for fertilization because it gives an abundant product compared to its miniature size. Hence, the importance of fertilization appears especially the leaf nourishment to complement the deficiency in some fundamental nutrition such as zinc and iron, which contribute to the increase of plants efficiency in producing fruits with high quality and quantity [17], [18].

Nano Technology is known as the precise mechanical treatment for the matter to reach dimensions of (1-100 nm). The purpose of this technology is the increase the productivity as well as the quality of the plant by increasing the usage of additive fertilizers as a source of nutrition [19], [20]. Nano fertilizers have a vital role in nourishing the plant whether through adding it to the vegetation or the soil. This is because they increase the photosynthesis process by increasing the leaf content of chlorophyll. Besides, they increase the crops' endurance of stress, resisting diseases, maintaining the required genes for different crops as well as increasing the active ingredients in the plant [21], [22].

The purpose of the study is to see the possibility of producing strawberries in the early months of winter under the protected environment through leaf nourishment with normal and Nano-produced zinc and iron. Also, the study was an indication of the effect of those elements in enhancing the vegetation, fruit, and root growth characteristics, not to mention the search for the optimum medium for the growth of strawberries under the protective environment.

2. Materials and Methods

The study was carried out in the greenhouse of the Department of Horticulture and Landscape Gardening at the College of Agriculture / University of Anbar for the growing season of 2019-2020. The purpose was to study the effect of media culture type and spraying with the microelements, zinc, and iron on the growth and yield of strawberry under the conditions of a greenhouse. Several Festival strawberry seedlings were prepared and produced under the tissue cultivation. The seedlings were treated with the fungicide (Uniform) with (1ml L^{-1}) of concentration before cultivation. The seedlings were planted in a plastic pot (19×19 cm) on the 15 of October. Table 1. shows the components of media culture that used in the experiment.

Table 1. Properties of the media culture.

			Soil			
Av. P mg Kg^{-1}	Total N %	$CaCO_3$ g Kg^{-1}	Bulk density g cm^{-3}	O.M %	EC ds m^{-1}	pH
2.213	0.011	216.36	1.29	0.08	0.72	7.47
Cl^- Mq L^{-1}	$HCO_3^=$ Mq L^{-1}	$CO_3^=$ Mq L^{-1}	Na^+ Mq L^{-1}	Mg^{++} Mq L^{-1}	Ca^{++} Mq L^{-1}	Av. K mg Kg^{-1}
2.69	1.40	Nil	0.12	6.20	7.40	37.62
	Texture		Clay g Kg^{-1}	Silt g Kg^{-1}	Sand g Kg^{-1}	$SO_4^=$ Mq L^{-1}
	Sandy		8.0	20.0	972.0	3.48
			Peat moss			
C/N	Organic matter g Kg^{-1}	Total K g Kg^{-1}	Total P g Kg^{-1}	Total N g Kg^{-1}	pH	EC ds m^{-1}
16.67	40.36	13.50	7.10	10.5	6.20	3.78
			Alfalfa			
C/N	Organic C g Kg^{-1}	Total K g Kg^{-1}	Total P g Kg^{-1}	Total N g Kg^{-1}	pH	EC ds m^{-1}
17.57	243.16	11.76	7.34	13.84	6.91	8.92
			Coantial			
C/N	Organic C g Kg^{-1}	Total K g Kg^{-1}	Total P g Kg^{-1}	Total N g Kg^{-1}	pH	EC ds m^{-1}
22.90	210.89	7.58	4.63	9.21	7.65	8.92
			Poultry waste			
C/N	Organic C g Kg^{-1}	Total K g Kg^{-1}	Total P g Kg^{-1}	Total N g Kg^{-1}	pH	EC ds m^{-1}
11.87	390.15	26.00	13.78	32.87	6.46	14.30

2.1 Treatments Used in the Experiment

Media culture: Three types of media culture used, and they consisted of:

1- River soil and Peat moss with a 3:1 ratio.
2- River soil and "50% Coantail + 50% Alfalfa" with 3:1 ratio.
3- River soil and Poultry waste with 3:1 ratio.

Those treatments were symbolled as (M1, M2, M3), respectively.

Spraying with normal and nano zinc and iron: both elements were sprayed with the following concentrations:

1- distilled water (control).
2- Normal zinc, 50 mg L^{-1} [23].
3- Nano zinc, 10 mg L^{-1}.
4- Nano zinc, 20 mg L^{-1}.
5- Normal iron, 150 mg L^{-1} [24].
6- Nano iron, 20 mg L^{-1}.
7- Nano iron, 40 mg L^{-1}.

Those treatments were symbolized as: (S1, S2, S3, S4, S5, S6), respectively. The spraying was mixed with soap (0.1 ml L^{-1}) as a spraying aid and was done early in the morning until complete wetness achieved. The soap was used to help reduce the surface tension for the spraying particles and to help the plant fully utilize the spraying solution. The spraying was done once every 20 days.

2.2 Data Analysis
A Factorial Experiment with Randomized Complete Block Design (R.C.B.D) was carried out using 21 experimental units divided into three blocks with seven experimental units for each block. Thereby, the total number of plants used in the experiment was 441 plants. Data was collected and compared using the Least Significant Difference Test (L.S.D) with a probability of 5% [25]. The data was analyzed using Genstat software.

2.3 The Measured Traits
The following responses were measured throughout the study:
1- The average number of flowers (flowers plant^{-1}).
2- The percentage of the flowers set.
3- The average number of fruits (fruit plant^{-1}).
4- The percentage of malformation fruits.
5- The average of fruit's weight (g fruit^{-1}).
7- The length and diameter of the fruit (cm).
8- The total yield of the plant (g plant^{-1}).

3. Results and Discussion

3.1 The Number of Flowers (flowers plant-1)
The results in Table (2) show that using a different media culture has a significant effect on the number of flowers, especially (M3), which gave the highest value of 34.4 flower plant^{-1}, whereas (M1) achieved the lowest value of 24.7 flower plant^{-1}. On the other hand, spraying with normal and nano zinc and iron showed a significant effect in the same response. The treatment (S5) gave the highest value of 32.8 flower plant^{-1}, whereas the treatment (S1) gave the lowest value of 27.1 flower plant^{-1}. The interaction between two study factors also showed a significance with the treatment (M3S5) where it gave the highest value of 42.0 flower plant^{-1}, whereas the control treatment (M1S0) gave the lowest result of 21.3 flower plant^{-1}.

Table 2. Effect of media culture (M) and spray with nano and normal microelements (S) on flowers number (flower plant-1) of strawberry cv. Festival.

Microelements / Media culture	M1	M2	M3	Mean
S0 Spray with distilled water only (Control)	21.3	28.9	31.2	27.1
S1 Normal Zn (50 mg L^{-1})	23.5	28.2	34.4	28.7
S2 Nano Zn (10 mg L^{-1})	22.6	32.5	35.3	30.1
S3 Nano Zn (50 mg L^{-1})	28.2	23.3	32.2	27.9
S4 Normal Fe (150 mg L^{-1})	26.7	26.5	32.0	28.4
S5 Nano Fe (20 mg L^{-1})	23.6	32.8	42.0	32.8
S6 Nano Fe (40 mg L^{-1})	26.8	29.1	33.9	30.0
Mean	24.7	28.8	34.4	
LSD $_{5\%}$	M	S	M×S	
	2.20	3.37	5.83	

3.2 The Percentage of the Flowers Set (%)
The results in Table (3) showed that using a different media culture resulted in a significant increase in the percentage of the flowers set especially at (M3) where it reached 77.5%, whereas (M1) achieved the lowest value of (61.4%). Spraying with microelements also gave significant results, the treatment (S5) gave the highest value at 76.5%, whereas the lowest value was given with the treatment (S0)

which was 61.3%. The interactions revealed a significant effect where the highest value was achieved with the interaction treatment (M3S5) at 83.4%, whereas the control treatment (M1S0) gave the lowest value which was 46.3%.

Table 3. Effect of media culture (M) and spray with nano and normal microelements (S) on flowers set (%) of strawberry cv. Festival.

Microelements / Media culture	M1	M2	M3	Mean
S0 Spray with distilled water only (Control)	46.3	69.0	68.7	61.3
S1 Normal Zn (50 mg L^{-1})	54.6	71.6	78.2	68.1
S2 Nano Zn (10 mg L^{-1})	58.3	73.4	79.3	70.3
S3 Nano Zn (50 mg L^{-1})	62.9	63.2	76.0	67.4
S4 Normal Fe (150 mg L^{-1})	62.7	67.5	76.5	68.9
S5 Nano Fe (20 mg L^{-1})	70.8	75.4	83.4	76.5
S6 Nano Fe (40 mg L^{-1})	73.9	72.5	80.2	75.6
Mean	61.4	70.4	77.5	
$LSD_{5\%}$	M	S	M×S	
	3.61	5.54	9.75	

3.3 The Percentage of Malformation Fruits (%)

Statistical analysis in Table (4) demonstrates that different types of growing media have a significant effect on the percentage of malformation Fruits. The media culture (M3) gave significant results at 14.9%, which was higher than other media (M1 and M2) where they gave (19.0 and 17.8%), respectively. As for spraying with zinc and iron elements, also the interaction between two factors where both haven't showed any significant effect on the percentage of malformation fruits. On the other hand, spraying with normal and nano zinc and iron showed a significant effect in the same response. The treatment (S5) gave the lowest value of 14.2%, whereas the treatment (S0) gave the highest value of 21.2%. The interaction between two study factors also showed a significance with the treatment (M3S5) where it gave the lowest value of 11.8%, whereas the control treatment (M1S0) gave the highest result of 26.1%.

Table 4. Effect of media culture (M) and spray with nano and normal microelements (S) on fruits malformation (%) of strawberry cv. Festival

Microelements / Media culture	M1	M2	M3	Mean
S0 Spray with distilled water only (Control)	26.1	17.0	20.4	21.2
S1 Normal Zn (50 mg L^{-1})	22.2	15.4	15.5	17.7
S2 Nano Zn (10 mg L^{-1})	18.6	15.6	13.9	16.0
S3 Nano Zn (50 mg L^{-1})	15.9	20.3	12.6	16.3
S4 Normal Fe (150 mg L^{-1})	17.7	21.5	16.0	18.4
S5 Nano Fe (20 mg L^{-1})	14.8	16.1	11.8	14.2
S6 Nano Fe (40 mg L^{-1})	17.4	18.8	14.2	16.8
Mean	19.0	17.8	14.9	
$LSD_{5\%}$	M	S	M×S	
	1.78	2.72	4.81	

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3.4 Number of Fruits (fruits plant-1)

The number of fruits per plant in different media has shown significantly different results, the media culture (M3) gave higher results 28.4 fruit plant^{-1} compared to (M0), which gave 17.3 fruit plant^{-1} (Table 5). Spraying with Zinc and Iron was also significant in this trait, the treatment (S5) gave a higher value, 25.6 fruit plant^{-1}compared to (S0) 18.8 fruit plant^{-1}. The interaction showed a significant effect, especially the treatment (M3S5) which gave the highest number of fruits per plant 31.2 fruit plant^{-1}, whereas the interactions (M1S0) gave the lowest numbers at 11.7 fruit plant^{-1}.

Table 5. Effect of media culture (M) and spray with nano and normal microelements (S) on fruits number (fruit plant-1) of strawberry cv. Festival

Microelements / Media culture	M1	M2	M3	Mean
S0 Spray with distilled water only (Control)	11.7	22.1	22.6	18.8
S1 Normal Zn (50 mg L^{-1})	12.8	22.5	29.4	21.6
S2 Nano Zn (10 mg L^{-1})	16.5	23.0	30.7	23.4
S3 Nano Zn (50 mg L^{-1})	18.3	16.4	28.6	21.1
S4 Normal Fe (150 mg L^{-1})	18.0	19.8	28.9	22.2
S5 Nano Fe (20 mg L^{-1})	20.2	25.6	31.2	25.6
S6 Nano Fe (40 mg L^{-1})	23.8	24.3	27.1	25.0
Mean	17.3	22.0	28.4	
LSD $_{5\%}$	M	S	M×S	
	1.54	2.36	4.08	

3.5 Weight of the Fruit (g)

The weight of the fruit was also affected by the type of the growing media where (M3) showed higher results, 21.50 g, compared to (M0 and M1) where the weight recorded was 16.00 and 17.48 g, respectively (Table 6). Spraying with zinc and iron showed significant effects as well, the treatment (S5) showed a higher value 21.12 g, whereas (S0) treatment gave a lower value at 15.43 g. The interactions between treatments gave the highest result for the weight of fruit, which was 25.58 g with (M3S5) treatment, compared to the control treatment (M1S0) that gave the lowest value as 13.37 g.

Table 6. Effect of media culture (M) and spray with nano and normal microelements (S) on fruit weight (g) of strawberry cv. Festival

Microelements / Media culture	M1	M2	M3	Mean
S0 Spray with distilled water only (Control)	13.37	15.46	17.46	15.43
S1 Normal Zn (50 mg L^{-1})	14.60	15.58	21.91	17.36
S2 Nano Zn (10 mg L^{-1})	18.81	18.67	20.51	19.33
S3 Nano Zn (50 mg L^{-1})	13.93	15.80	23.76	17.83
S4 Normal Fe (150 mg L^{-1})	15.36	16.43	21.23	17.67
S5 Nano Fe (20 mg L^{-1})	17.20	20.57	25.58	21.12
S6 Nano Fe (40 mg L^{-1})	18.74	19.81	20.06	19.54
Mean	16.00	17.48	21.50	
LSD $_{5\%}$	M	S	M×S	
	1.32	2.02	3.50	

3.6 Length of Fruit (cm)

The result in Table (7) reveals that the length of fruit was affected by the type of growing media used, especially (M3) which gave a significant value at 4.28 cm. On the other hand, the media culture (M1) gave a lower value at 3.62 cm. Spraying with microelements gave significant results as well, (S5) treatment gave the highest value, 4.20 cm, compared to (S0), which gave a lower value 3.61 cm. The binary interactions also gave significant results, the highest value for the length of fruit was at (M3S5) where it gave 4.72 cm compared to the control treatment (M1S0) that gave the lowest value as 3.14 cm.

Table 7. Effect of media culture (M) and spray with nano and normal microelements (S) on fruit length (cm) of strawberry cv. Festival

Microelements / Media culture	M1	M2	M3	Mean
S0 Spray with distilled water only (Control)	3.14	3.43	4.27	3.61
S1 Normal Zn (50 mg L^{-1})	3.35	4.18	4.00	3.84
S2 Nano Zn (10 mg L^{-1})	4.33	3.93	4.23	4.17
S3 Nano Zn (50 mg L^{-1})	3.37	3.61	4.48	3.82
S4 Normal Fe (150 mg L^{-1})	3.54	4.43	4.15	4.04
S5 Nano Fe (20 mg L^{-1})	3.64	4.24	4.72	4.20
S6 Nano Fe (40 mg L^{-1})	3.95	4.36	4.09	4.13
Mean	3.62	4.03	4.28	
$LSD_{5\%}$	M	S	M×S	
	0.24	0.35	0.63	

3.7 The Diameter of Fruit (cm)

Table (8) shows significant results in terms of the diameter of fruit. The media culture (M3) gave a higher value, 3.37 cm, compared to (M1), which gave a lower value at 2.70 cm. Spraying with the elements nano and normal zinc and iron showed a significant effect with the treatment (S5), which gave 3.42 cm, compared to the treatment (S0), which was significantly lower 2.75 cm. The interaction also showed significant variance in the values where the treatment (M2S5) achieved the highest results for this trait 3.84 cm, whereas the control treatment (M0S0) showed the lowest value of 2.16 cm.

Table 8. Effect of media culture (M) and spray with nano and normal microelements (S) on fruit diameter (cm) of strawberry cv. Festival

Microelements / Media culture	M1	M2	M3	Mean
S0 Spray with distilled water only (Control)	2.16	2.71	3.37	2.75
S1 Normal Zn (50 mg L^{-1})	2.50	3.00	3.35	2.95
S2 Nano Zn (10 mg L^{-1})	3.07	3.19	3.29	3.19
S3 Nano Zn (50 mg L^{-1})	2.73	2.93	3.26	2.98
S4 Normal Fe (150 mg L^{-1})	2.86	3.63	3.21	3.24
S5 Nano Fe (20 mg L^{-1})	2.65	3.84	3.76	3.42
S6 Nano Fe (40 mg L^{-1})	2.94	3.18	3.37	3.16
Mean	2.70	3.21	3.37	
$LSD_{5\%}$	M	S	M×S	
	0.16	0.24	0.43	

3.8 Yield (g plant^{-1})

The results in Table (9) show that using different growing media affected the yield, especially M3, which gave a higher value of 628.1 g plant^{-1}, whereas the media culture (M1) gave the lowest value at 278.5 g plant^{-1}. On the other hand, treatments with microelements showed significantly different values in treatment (S5) which gave higher result 554.4 g plant^{-1}), in comparison to treatment (S0) of 291.4 g plant^{-1}. As for the interaction between two factors, the treatment (M3S5) was superior and gave the highest value 782.4 g plant^{-1}, whereas the control treatment (M0S0) gave the lowest result as 173.5 g plant^{-1}.

Table 9. Effect of media culture (M) and spray with nano and normal microelements (S) on yield (g plant-1) of strawberry cv. Festival

Microelements / Media culture	M1	M2	M3	Mean
S0 Spray with distilled water only (Control)	173.5	305.0	395.8	291.4
S1 Normal Zn (50 mg L^{-1})	210.6	302.2	669.4	394.1
S2 Nano Zn (10 mg L^{-1})	309.5	447.6	634.3	463.8
S3 Nano Zn (50 mg L^{-1})	283.9	274.3	685.6	414.6
S4 Normal Fe (150 mg L^{-1})	289.1	342.1	637.8	423.0
S5 Nano Fe (20 mg L^{-1})	343.5	537.3	782.4	554.4
S6 Nano Fe (40 mg L^{-1})	339.3	493.7	591.2	474.7
Mean	278.5	386.0	628.1	
LSD $_{5\%}$	M	S	M×S	
	35.74	54.60	94.56	

The effect of spraying with normal Zinc and Iron on increasing the traits of the yield perhaps is due to the role of zinc in protein manufacturing and Maintain cell membrane and cell elongation functions [26]. Zinc also contributes to the forming dehydrogenase enzyme and producing Auxin, which increases the cellular elongations [27], in addition zinc has prime roles as a structural, regulator, or a common factor for a variety of enzymes and proteins that are specialized in biochemical paths and the metabolism of carbohydrates. It is also considered the main contributor in converting saccharides into starch, metabolism of proteins, regulation of Auxin, and pollen formation [28]. Also, zinc is a major component in the formation of Tryptophan amino acid, which has a vital role in the formation growth regulator (IAA), which enhances the cells activity, division, internodes elongation, and formation of the cell membrane, Ectoplasm [29].

The significant increase in the yield and its components is due to the effect of iron as it is part of the formation of different enzymes such as Catalase, Peroxidase, and Cytochrome oxidase, all of which help regenerate many biological processes [30], [31]. It is also linked to metabolism, photosynthesis, protein manufacturing, and Chlorophyll particles [32], [33]. Iron is also considered as a cofactor for about 140 of the enzymes that help catalyze the unique chemical reactions and increases the effectiveness of biochemical conversion [34].

The reason behind the superiority of Nano fertilizers compared to the standard treatment is due to the size of the particles, the preciseness of manufacturing, which allows the penetration and swift movement inside the plant tissues. This leads to the stimulation of hormones inside the plant, which encourages the secondary roots, which reflects positively upon the growth and yield of plants [35]. Besides, when those elements enter the plant and link to the protein carriers (such as Aquaporin, Endocytosis, and Ion channels) will lead to the formation of new holes penetrating through the cell membranes. This triggers the plant to absorb more water, which will help increase the growth and yield of the plant. Nano zinc helps elongation of cells, increases the flexibility of the wall, which increases the growth for the most part [36]. Nano iron has great efficiency in penetrating the cell membrane reaching the functional sites, which are essential for chlorophyll manufacturing through photosynthesis, enhances energy transmission, metabolism, cell division, increasing of leaf's area, as well as the stem and cortex thickness, which increases the yield [37]. Moreover, using Nano iron will lead to an increase in the efficiency of H-ATPase Enzyme in the plasma membrane of the guard cells, which results in the increase of stoma opening five times more compared to the natural state. This will allow more carbon dioxide to enter and increase the efficiency of photosynthesis [38], [39].

In general, nano fertilizers can increase metabolism rates. The diameter ranges between (1-100 nm). They have a high surface area that leads to a high reaction rate, increase the absorption of elements while slowly releasing them, which leads eventually to increasing the growth, and it reflects upon the increasing of yield through the increase of photosynthesis [40]. This will encourage vegetation growth and enhance the plant's capacity for photosynthesis.

Different growing media have a positive effect on increasing the yield and the traits. Different media have an important role in improving the physical, chemical, and biological properties, and producing Humic acids, lowering pH of the soil, and increase their temperature. This will increase roots' growth and penetration, increasing the number and activation of the microorganisms, which will result in nutrition absorption thereby improving vegetation growth. This will lead to increasing of photosynthesis and accumulation in the storage parts of the plant. This has a positive effect in increasing the yield of the plant [41], [42]. Growing media have different nutrition components such as (Potassium, Phosphorous, and Nitrogen) that are necessary for a plant to grow. They have an important role in the stimulation of photosynthesis and affecting carbohydrates formation and transport to the storage parts (flowers and fruits). Strawberry fruits are considered as the most competitive part of plant for the accumulation of carbohydrates up to (%20-40) of the dry weight of the plant [43]. This results in increasing the number of the fruit, their weight, diameter, and length, thereby increasing the yield per plant. Organic fertilizers contribute to increasing the activity of enzymes inside the plant [44] and growth regulators such as Auxins [45], Gibberellin [46], and Cytokinin [47]. Those hormones help increase flowers setting and improve fruit properties due to the reduction of competition between the vegetation and flowering. The CEC also increases due to adding organic fertilizers, which results in liberation and capturing of the positive ions such as K^+, as well as increasing its readiness [48].

4. Conclusion

In conclusion, Cultivation of strawberry in different media culture, especially the ones that contain Poultry waste and plant waste (Coantail and Alfalfa) as well as spraying with nano and normal zinc and iron is an effective method in nutrition of plant, it helped increase the yield and improve its traits. Therefore, we recommend planting strawberry in organic media including animals or plant waste. Also, we recommend spraying with nano and normal zinc and iron as an effective method of fertilizing resulting in increasing the flowering traits, as well as the yield.

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