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Effect of Organic Additives of Okra Cultivated in Unheated Greenhouses on Certain Fruit Characteristics

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Abstract : **The experiment conducted during the winter season 2017-2018 in one of the unheated greenhouse in the Research Station of the Faculty of Agriculture collage - All Muthanna University in the south of Iraq in All Samawah city, in order to study the "Effect of addition cows fertilizer , Water hyacinth compost and spray nanoparticle algae minutes and there impact on some qualities of okra fruits (Hasnawiya cultivar)". The experiment was contain (27) factor treatments and separated in possible combinations among three levels of bovine fertilizer (0, 2, 4) kg/m^2 and three levels of Water hyacinth compost (0, 2, 4) kg/m^2 and three concentrations of Organic fertilizer for marine algae nanoparticles extract (0, 0.75, 1.5) ml/L.**

The statistical design is split-split plot design and the experiment performed twice for three randomized sections and compared to the averages of the coefficients using the least significant difference test at the probability level (0.05). The main results are summarized as follows.

1. **The addition of bovine fertilizers in the levels of (2, 4) kg/m^2 the Significant increase in the percentage of total soluble solids for fruits, by an increase of (8.64, 7.08%) and dry matter of fruits by an increase (6.04, 9.78)%. Significant increase in fiber content (0.56 and 0.95%) compared to the comparison treatment, respectively, while the level of 4 kg/m^2 achieved significant increase in fruit content in vitamin C compared to the comparison treatment and an increase of 5.16%.**
2. **Levels (2 , 4) kg/m^2 Significant increase in percentage of total dissolved solids Vitamin C increased by 24.85, 42.23% by 20.02 and 27.00% by the percentage of dry matter and by 9.91 and 12.81%, which led to a significant decrease in fiber percentage by 6.28 and 11.78% Comparative treatment, respectively.**
3. **Spraying with nanoparticle algae minutes in two concentrations (0.75 and 1.5) ml/l significantly increased the percentage of total dissolved solids by (27.13, 53.87)% and in the amount of vitamin C by (24.05 and 50.01%) and in percentage. The dry matter of the fruit increased by 5.90 and 12.36%, which resulted in a significant decrease in the percentage of fiber by 3.74 and 1.85% compared to the comparison treatment, respectively.**
4. **Some bilateral and triple interference showed significant effect in some studied traits.**
5.

Keywords: Okra plant, cow manure fertilizer, Water hyacinth compost, organic nutrient, nanoparticle algae, total TDS, vitamin C, percentage of dry matter and fiber ratio.

***The research is part of MSc for 1st author**

I. INTRODUCTION

The increased demand in recent years for food produced using organic media free from chemical additives as they provide a healthy and safe food for humans (Abu Rayyan, 2010).

Organic fertilizers are fertilizers that increase the organic matter in the soil and influence the release of major nutrients such as nitrogen, phosphorus and potassium and the work of compounds Chelating with microelements and

continuous and balanced processing of elements that accompany the growth and development of the plant and improve the physical properties of the soil represented by aeration and soil holding capacity of water and thus increase vegetative and syphilis growth (Jahan and Jahani, 2006).

It is also a source of encouraging Growth such as kaoxins, amino acids and vitamins and give the plant the ability to grow and develop and increase the plant's absorption of the elements and thus increase the efficiency of photosynthesis process and increase the accumulated processed materials in the plant, which is reflected in improving the qualitative qualities of the fruits (Vildirim, 2007), which gives high quality and quality fruits as high content In addition to reducing the harmful effect of salinity on the plant, it is possible to produce a crop that carries healthy food and restores the environment to its equilibrium (Ewulo *et at* 2008) indicated that spraying okra plants with marine algae extract at a concentration of 2.5% caused a significant increase in fruit content of vitamin C and fiber compared to non-spray treatment. (Olaniy *et al* 2010) observed when using organic material for okra plants At the rate of 4 tons. E-1 had a significant effect in increasing fruit content of vitamin C and fiber compared to comparison treatment. (Adewole and llesanmi 2011).

The uses of $6t/h^{-1}$ organic fertilizer caused a significant decrease in the content of okra fruits fiber, while not significantly affected the content of vitamin C and carbohydrates and got (Gayathri and Krishnaveni 2015) when using $20t/h^{-1}$, farm residues of okra plants showed a significant decrease in the percentage of fiber and an increase in the percentage of protein and vitamin C compared with the recommended NPK chemical fertilizer, and among (Frimpong *et.al* 2017).

The use of 200 kg/h^{-1} mixture of residues of cows, poultry, corn husks and domestic ash significantly affected Okra fruits of carbohydrates and fiber increased (13.75, 12.9%) compared to the treatment of headquarters respectively. He observed (Poonkodi *et al* 2018) when using a recommended conventional fertilizer with $15t/h^{-1}$compost caused a significant increase in the content of okra fruits of vitamin C while the percentage of fiber decreased compared with the recommended conventional fertilizer treatment and (Smritia and Ram 2018) reported that The use of farm residues of okra plants resulted in a significant increase in the percentage of total soluble solids and vitamin C in the fruits compared with the comparison coefficient (Santos *et al* 2019) confirmed that the addition of compost to okra plants at the level of 30 tons. In their content of vitamin C while not significantly affected the ratio of total soluble solids (Sureshkumar et al 2019) when sprayed okra plants extract marine algae concentration (0, 50 ,100) ppm exceed the high concentration of 100 ppm significantly increase in fruit content of vitamin C and a significant decrease in the content of fiber, compared with the comparison treatment.

Due to the lack of previous studies in the country when planting okra plants in unheated plastic houses and the addition of cows compost and Water hyacinth compost as a soil enhancer and foliar spraying nanoparticle algae minutes and their effect on some qualitative characteristics of the fruits of okra variety Hasnawiya conducted this study.

II. Materials and working methods:

The experiment was conducted in the winter agricultural season 2017-2018 in one of the greenhouses of heated dimensions (50 × 9) m and an area of 450 m^{-1} in the agricultural research station (Al Bandar) affiliated to the Faculty of Agriculture, Muthanna University. Table (1) shows some physical and chemical properties of the soil and the irrigation water used:

The land of the plastic house was plowed perpendicularly to the plow and then flattened. 40 cm Exhibit and the distance between the line and the other 90 cm, the seeds of okra variety Hasinawia were planted on 1/12 in the middle of the terrace after soaking them for 12 hours in a gore away from each other 40 cm .Drip irrigation system After two weeks of planting, the plants were reduced to two plants per jar. Mulching black polyethylene tender was used to cover the lines before planting with a thickness of 0.8 micron and 80 cm wide for the purpose of getting rid of the bush and increasing soil heating. The agricultural service was used to produce the crop from fertilizer, irrigation and harvesting uniformly and for all experimental units (Matlab *et al*., 1989)

Table (1) Physical and Chemical Characteristics of Field Soil and Irrigation Water Samples

Type of analysis	Measuring unit	Field soil	Irrigation water	Method
EC (1: 1)	$ds.m^{-1}$	4.9	4.5	Page *et al*. (1982)
TDS	$g.L^{-1}$	1.9	2.2	
NaCL	%	5.3	6.1	
PH	-----	7.6	7.1	
Ready Nitrogen	$mg.k^{-1}$	4.7		
Ready phosphorus	$mg.k^{-1}$	3.1		
Ready Potassium	$mg.k^{-1}$	230		Black (1965)
Organic matter	%	0.58		
Excess density	$g.cm^{-3}$	1.317		
Real density	$g.cm^{-3}$	2.502		
porosity	%	47.36		
Clay ratio	%	32		
Silty ratio	%	62		
Sand ratio	%	6		
Soil tissue	----	Alluvial clay		

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The second factor is the addition of Water hyacinth compost before planting (0, 2, 4) kg. Water hyacinth after analysis.

Table (2) Characteristics of Cows Boom and Water hyacinth Compost after Decomposition

Type of analysis	**Measuring unit**	**Bettmoos cows**	**Water hyacinth Compost**	**Method**
EC	**ds.m-1**	**4.2**	**2.3**	**Page *et al.* (1982**
PH	**-----**	**7.1**	**7.2**	

TDS	**g.L-1**	**2.1**	**1.1**	
NaCl	**%**	**4.3**	**2.4**	
Organic C	**mg.k-1**	**1025.4**	**1644.2**	
N total	**mg.k-1**	**54.7**	**85.4**	
N / C	**-----**	**18.74**	**19.25**	
P total	**mg.k-1**	**12.3**	**9.9**	
K total	**mg.k-1**	**174.8**	**188.7**	

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The third factor is spraying with three concentrations of nanoparticles of seaweed extract (0.5, 0.75, 1.5) ml. L-1 by two sprayings, 25 days after germination and 20 days after the first spray.

Table (3) Seaweed Content

Plant hormones(%)		**Micro elements (ppm)**		**Macro element (%)**	
Auxin	0.027	Fe	150	Organic(N)	3.43
Cytokinin	0.021	Mn	18	P_2O_5	2.44
		B	4	K2O	4.55
		Zn	75	Mg	0.68
				Ca	0.42

A split-split plot design was carried out twice according to the design of full randomized segments with three replicates.Commit bovine fertilizer levels were reported as the main plot, Water hyacinth compost levels as a sub-plot agent and spray concentrations with nanoparticle extract as sub-plot agent. I counted all three contiguous lines as one sector. The number of experimental units was 81 units, the length of each unit is 4.8 m, the width of 0.9 m, the number of plants has 24 plants, and the intervals between the experimental units were 0.4 m. The chemical composition of the leaves was determined by taking the fourth leaf from the top of the number of plants from each experimental unit (Wlsh and Beatous, 1973) after 60 days of germination. The method described by (Goodwin, 1976) 2- Leaf content of total dissolved carbohydrates (mg. 100 g^{-1} dry tissue) 3- Percentage of nitrogen according to the method described before (Pag et.at, 1982). Percentage of phosphorus according to the method described before (Murphy and Ritey, 1962). Percentage of potassium according to the method described above (Pag et.at, 1982). Percentage of sodium according to the method described above (Pag et.at, 1982).

Specific qualities of fruits were estimated, including:

1- The ratio of dry matter in fruits was calculated by the following equation

Dry weight of fruits / wet weight of fruits x 100

2- Percentage of Total Soluble Solids Using Refractometer as described (A.O.A.C, 1970)
3- Vitamin C (ascorbic acid) mg 100 g-1 soft weight as described in (A.O.A.C, 1970)

Percentage of fibers according to the method described in (A.O.A.C, 1970)

The results were analyzed statistically according to the design followed and compared between the arithmetic averages using the lowest significant difference at the probability level **0.05** using the computer for statistical analysis.

III. Results and discussion:

It is clear from Table (4) that the addition of bovine fertilizer level (2, 4) kg t/h^{-1} has caused a significant increase in the percentage of total dissolved solids of the fruits by an increase of (8.64,7.08%) compared with the comparison treatment, respectively. Both levels differed significantly, while the high added level of 4 kg m -1 caused significant increase in the fruit content of vitamin C compared to the comparison treatment by an increase of 5.16% and the level 2 kg m -1 did not differ significantly.

The addition of Water hyacinth compost at levels (2 and 4) kg.m^{-1} showed a significant increase in the fruit content percentage of total soluble solids and vitamin C and an increase of (42.23,24.85)%, (27.00,20.02)% compared with the comparison treatment Respectively, the effect increased significantly with the addition level.

As for the spraying of marine algae nanoparticles, spray concentrations (0.75 and 1.5) ml^{-1} were significantly affected in the fruit content in the percentage of total soluble solids and vitamin C with an increase of (53.87,27.13)% (50.01,24.05)%. The effect was significantly increased by increasing the spray concentration.

It is shown from the same table that the bilateral and tertiary interactions did not significantly affect both traits except the overlap between the levels of Water hyacinth compost and spraying with nanoparticle algae minutes. Plants gave C_2N_2 the highest values of 8.361%, 42.00 mg. 100 g^{-1} tender weight while plants C_0N_0. The lowest values were 4.528% and 21.44 mg.100 g^{-1}.

The significant increase in organic matter in the percentage of total soluble solids and vitamin C in fruits to their role in increasing the readiness of nutrients in the soil crop and then absorbed by the plant or by spraying directly on the leaves leading to the strength of vegetative growth and increase the output of the construction process Photosynthesis due to the activity of the enzymes involved in this process and its transfer to fruits (Abu Dahi and Younis 1988), including carbohydrates that are necessary for the formation of ascorbic acid (Bendere, 2003) and these results are consistent with what was obtained (zodaqe et al, 2008 and olaniyi et al, 2010 Gayathri and krishnaveni, 2015 and poonkodi et al, 2018 and smritia and ram, 2018)

Table (4) Effect of Cow Fertilizer, Water hyacinth Compost, Spraying with Nanoparticles and their Interaction in Total Soluble Solids (%) and Fruits Content of Vitamin C (mg. 100 g -1 t).

Fertilizer cows T	Water hyacinth C	Total TDS				Fruit content of vitamin C			
		Seaweed N			T * C	Seaweed N			T * C
		N0	N1	N2		N0	N1	N2	
T0	C0	4.333	4.667	5.500	4.833	18.67	27.67	38.00	28.11
	C1	4.667	5.250	7.917	5.944	27.33	35.67	40.67	34.56

	C2	5.167	7.833	7.667	6.889	31.33	36.33	40.67	36.11
T1	C0	4.500	4.833	6.000	5.111	22.33	28.00	38.00	29.44
	C1	4.833	6.417	8.833	6.694	27.67	35.67	42.00	35.11
	C2	5.333	8.083	7.917	7.111	32.33	36.67	42.00	37.00
T2	C0	4.750	4.917	6.083	5.250	23.33	28.33	38.67	30.11
	C1	5.000	5.833	8.167	6.333	28.00	36.00	42.67	35.56
	C2	5.333	8.000	9.500	7.611	33.00	38.33	43.33	38.22
$L.S.D_{0.05}$		N.S			N.S	N.S			N.S
Rate of seaweed effect		4.880	6.204	7.509		27.11	33.63	40.67	
$L.S.D_{0.05}$		0.4495				1.133			
					rate of cow manure effect				rate of cow manure effect
T * N	T0	4.722	5.917	7.028	5.889	25.78	33.22	39.78	32.93
	T1	4.889	6.444	7.583	6.306	27.44	33.44	40.67	33.85
	T2	5.028	6.250	7.917	6.398	28.11	34.22	41.56	34.63
$L.S.D_{0.05}$		N.S			0.3784	N.S			1.271
					Rate of Water hyacinth effect				Rate of Water hyacinth effect
C * N	C0	4.528	4.806	5.861	5.065	21.44	28.00	38.22	29.22
	C1	4.833	5.833	8.306	6.324	27.67	35.78	41.78	35.07
	C2	5.278	7.972	8.361	7.204	32.22	37.11	42.00	37.11
$L.S.D_{0.05}$		0.7508			0.4418	1.819			0.962

And from Table (5) that the addition of bovine fertilizer cows at levels (2 , 4) $kg.m^{-1}$ has caused a significant increase in the proportion of dry matter compared to the comparison factor and by an increase of (9.78,6.94)% has increased the effect significantly by increasing the level of addition, While both levels caused a significant decrease in the percentage of fiber in fruits and a decrease of (0.95,0.56)%, respectively, and did not differ significantly between the two levels.

Also, the level of addition of compost Water hyacinth (2 , 4) kg.m^{-1}significant increase in the percentage of dry material for fruits compared to the comparison factor and an increase of (12.81,9.91)%, respectively and did not differ significantly both between them and when they caused a significant decrease. The percentage of fibers compared to the coefficient of comparison and a decrease of (11.78,6.28)%, respectively and the effect increased significantly by increasing the level of addition.

As for spraying with marine algae nanoparticles, both concentrations (0.75 and 1.5) mL caused a significant increase in the percentage of dry matter compared to the comparison factor and an increase of (12.36,5.90)% respectively. Whereas, there was a significant decrease in the proportion of fibers compared to the comparison factor and a decrease of (1.85,3.74)% respectively. The decrease was significantly increased in spray treatment with concentration (0.75) mL^{-1} compared to high concentration (1.5) mL^{-1} and with a decrease. It reached 1.92%.

It is shown from the same table that the bilateral interactions did not significantly affect these traits except the interaction between the levels of cow manure and spray concentrations in nanoparticle algae particles in dry matter ratio. The interaction between Nile compost levels and the concentration of spraying with nanoparticles was significantly affected by the percentage of fibers if the C_2N_0 plants gave the lowest percentage of 8.706% while the C_0N_0 plants gave the highest percentage of 11.001%. Ratio of dry matter has only given treatment plants $T_2C_2N_2$ the highest rate of 17.21% while given treatment plants $T_0C_2N_0$ the lowest rate stood at 12.90%.

The significant increase in the addition of organic matter in the ratio of dry matter to fruits may be due to the fact that it is a complete fertilizer and its decomposition is slow and contains most of the nutrients involved in the formation of carbohydrates, which are the main component of the dry matter (Morsi et al., 1973) This result is consistent with what happened (Ismail, 2013) In the increase of dry matter significantly for eggplant fruits when adding rice straw compared to the comparison treatment. Low fiber percentage when adding organic matter may be attributed to its role in changing the acidity of cytoplasm cells leading to the decomposition of the fiber constituents which are cellulosic materials. This is consistent with what he got (Adewoie and IIesanmi, 2011, Gayatwri, krishnaveni 2015, Poonkodi et at, 2018 and Sureshkumar et at, 2019).

Table (5) Effect of Cow Fertilizer, Water hyacinth Compost, Spraying with Nanoparticles and their Interaction on Dry Matter Ratio of Fruits (%) and Fruits Content of Fibers(%).

Fertilizer cows T	Water hyacinth C	Percentage of dry matter in fruits(%)				Fruit content of fiber(%)			
		Seaweed N			T * C	Seaweed N			T * C
		N0	N1	N2		N0	N1	N2	
T0	C0	13.61	14.01	14.87	14.16	11.163	9.983	9.960	10.369
	C1	14.63	15.13	16.38	15.38	9.877	9.357	9.760	9.664
	C2	12.90	16.16	16.61	15.22	8.743	9.233	9.290	9.089
T1	C0	14.46	14.80	15.38	14.88	10.950	9.893	9.927	10.257
	C1	15.40	15.68	16.07	15.72	9.820	9.290	9.753	9.621
	C2	16.10	15.88	16.46	16.15	8.713	9.197	9.327	9.079
T2	C0	14.50	14.82	15.70	15.01	10.890	9.873	9.853	10.206
	C1	15.49	16.09	16.89	16.16	9.763	9.270	9.787	9.607

	C2	16.45	16.79	17.21	16.82	8.660	9.160	9.273	9.031
$L.S.D_{0.05}$		1.093			N.S	N.S			N.S
Rate of seaweed effect		14.84	15.48	16.18		9.842	9.473	9.659	
$L.S.D_{0.05}$		0.364				0.0861			
					rate of cow manure effect				rate of cow manure effect
T * N	T0	13.71	15.10	15.95	14.92	9.928	9.524	9.670	9.707
	T1	15.32	15.45	15.97	15.58	9.828	9.460	9.669	9.652
	T2	15.48	15.90	16.60	15.99	9.771	9.434	9.638	9.614
$L.S.D_{0.05}$		0.587			0.381	N.S			0.0525
					Rate of Water hyacinth effect				Rate of Water hyacinth effect
C * N	C0	14.19	14.54	15.32	14.69	11.001	9.917	9.913	10.277
	C1	15.17	15.63	16.45	15.75	9.820	9.306	9.767	9.631
	C2	15.15	16.27	16.76	16.06	8.706	9.197	9.297	9.066
$L.S.D_{0.05}$		N.S			0.447				0.0733

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