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Effect of Nano and Organic fertilizers on some vegetative growth characteristics of Phoenix dactylifera C.V Khastawi

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Abstract

The experiment was conducted in Al-Hussainiya palm plant / Holy Karbala governorate affiliated to the Ministry of Agriculture /Horticulture Department during the growing season of 2021 AD, with the aim of knowing the effect of nano-fertilizers and marine extracts on some vegetative growth characteristics of the date palm variety Al-Khastawi .A two-factor experiment was carried out according to a randomized complete block design (RCBD) with three replications, first factor was the addition of nano-fertilizer to the soil at four concentrations (0, 0.5,1 ,1.5 ml . liter-1. palm-1) while the second factor included spraying with algal extracts fertilizer at four concentrations (0, 1.5, 2.0 ,2.5 ml. liter-1. palm-1) where the nano-fertilizer was added to the soil by three additions and at the rate of one addition per month, while the spray treatment with algae fertilizer was six sprays between each spray and two weeks, and it was the first addition of nano-fertilizer to trees. The date palm was dated 1/3/2021, while the first application of algal fertilizer was on 3/3/2021. The results showed that the treatment with nano-fertilizer at a concentration of 1.5 ml. liter-1. palm-1 was significantly superior in most of the studied traits (leaf length 3.38 cm, wet weight 41.19 gm). Furthermore, the treatment of spraying with algal manure extract at a concentration of 2.5 ml. liter-1. palm-1 was significantly superior in most of the studied traits (leaf length 51.83 cm, dry weight 56.96%, chlorophyll 12.56 mg g-1). Additionally, the interaction between the two fertilizers, nano-fertilizer and marine algae extracts, showed significant superiority in all studied traits.

Keywords: Chlorophyll, dry weight, leaf length and wet weight

Introduction

The date palm *Phoenix dactylifera* L. is a blessed tree known to the Arabs since ancient times and mentioned in the Holy Qur'an. It is one of the dioecious trees, monosexual, planted in Iraq. Its cultivation spreads in the areas confined between latitudes 10 -300 north of the equator and extends to latitude 20 south It belongs to the family Arecaceae and to the order Palmae. This family is one of the oldest families of monocotyledonous flowering vascular plants [1] Iraq is one of the oldest palm-growing areas in the world, and the number of cultivated varieties is estimated at about 600

[2]. Fertilization is one of the most important service operations necessary for the date palm, as it, like other plants, needs to fertilize with nutrients on a regular basis and without neglecting this important process for palm trees significantly [3] . where fertilization plays an important role in improving the growth of trees and providing the food necessary for their good growth. Most of the orchards in which palm cultivation is spread in the southern and central regions of Iraq have shown signs of general weakness and pallor or their edges may wither, which is one of the manifestations of a lack of mineral elements as a result of palm growers neglecting many agricultural operations, especially fertilization [4]. Studies have shown that the use of nanofertilizers causes an increase in the efficiency of the use of nutrients, and reduces their toxicity to revive the soil, as well as reducing the effects of potential stresses resulting from increased fertilization and reduces the use of fertilizers, and that nanotechnology has high potentials to achieve sustainable agriculture [5] Also, foliar fertilization helps fill the plant's needs of nutrients, and it is efficient and effective Speed in the absorption of nutrients, especially when soil conditions are not suitable for absorption, such as drought, sharp rise and fall in temperature, loss by washing, and other factors that affect the facilitation of the elements for absorption, as well as providing the plant with nutrients in a homogeneous manner [6].

The seas, oceans and rivers are the source of many materials that modern science is still discovering the secrets of this strange world, including algae and seaweeds, which are considered to be used. One of the causes of environmental pollution, as the liquid fertilizers derived from seaweed outperformed the chemical fertilizers because of their high content of organic matter, macro and micro nutrients, vitamins and fatty acids and are also rich in plant growth regulators [7].

Materials and Methods

Executing the experiment

The research was conducted during the growing season of 2021 AD in the Hussainiya date palm pant / Horticulture Department in the Holy Karbala Governorate affiliated to the Ministry of Agriculture.

Field preparation and agricultural operations:

The 48 palm trees were selected from the date palm trees of the Khastawi variety, with 16 palms per replicate, homogeneous in vegetative growth as much as possible, at the age of 7 years, planted in clay soil in regular lines (10 x 10 m) and irrigated with Euphrates water by drip irrigation method. All agricultural service operations were conducted as a two-factor experiment using Randomized Complete Block Design(R.C.B.D):

The first factor (Loenergy Plus nano-fertilizer): with four concentrations (0 , 0.5 , 1 and 1.5ml. L^{-1} . $palm^{-1}$). It is produced by the Turkish company Agrisenses, which

consists of the major elements expressed in percentage as mentioned in the company's bulletin and as follows:

Table (1): Composition of Nano Fertilizer Loenergy Plus

potassium oxide	phosphorous oxide	Nitrogen pentoxide
12%	12%	10%

The second factor(Agazone Mix 30) is the spraying of the vegetative mass with organic fertilizer at four concentrations (0 , 1.5 , 2.0 and 2.5 ml L^{-1} . $palm^{-1}$) It is produced by Al-Joud Company for Modern Agricultural Technology affiliated to the Abbasid shrine in the Holy Karbala Governorate, which consists of more than 30 natural compounds and 4.5% K_2O Natural growth stimulants (auxins - gibberellins - cytokines - amino acids - carbohydrates) Minor elements (manganese - magnesium - calcium - zinc - boron - iron - sulfur - - copper) .All levels of fertilizers were added with reverse osmosis water (RO) ,as each concentration of nano fertilizer Loenergy Plus (0,0.5,and 1.5) $ml.L^{-1}$ was added by 20 liters of water (RO) , if the first concentration was $0.5ml.L^{-1}$,10 ml was added for every 20 liters of water (RO) and thus the second addition at a concentration of 1 $ml.L^{-1}$ that is 20ml per 20liters water (RO) and the third addition at a concentration of 1.5 ml.L-1 , 30 ml per 20 liters water (RO) , started from the month of March until the end of June and on three batches for each month , adding fertilizer for each month , in addition to the comparison treatment and it was as follows: (1/3 /2021,31/3/ 2021,30/4/ 2021) , as for spraying with algae extracts, it is in the form of two spraying treatments for every two months, a total of six sprays during the research period.(3/3/2021, 18/3/2021, 1/4/2021, 16/4/2021, 1/5/2021, 16/5/2021)Thus , the number of treatments for the sector is (4x4), and it was repeated with three replications, and the experimental unit included one palm. The averages were compared according to the least significant difference (L.S.D) test under a probability of 0.0 5% [8] and the data were analyzed using the statistical program GenStat.

Attributes and measurements studied during the experiment:
phenotypic traits:

Leaf length (frond) cm:

It was measured by measuring tape (five fronds were taken from the center of the tree) for each treatment.

Leaf Length (Alkhassa) cm:

It was measured using a ruler (ten tufts were taken from the center of the fronds taken at random).

The average dry weight of the leaf (Alkhassa) %:-

The wet weight of the vegetative mass was calculated by a sensitive scale, then placed in paper bags and dried in an electric oven at a temperature of (70) m^0 for a period of (48) hours, until the weight was established and the percentage of dry matter was extracted.

Dry matter percentage = dry weight / wet weight x 100

The fresh weight of the stalk leaves (mg. g^{-1}):

It was done using a sensitive scale, as the above wicker were taken and the fresh weight of the wicker was recorded.

Total chlorophyll content of fresh leaves (mg. g^{-1} wet weight):

The content of fresh leaves of total chlorophyll was calculated according to the method described in [9] where a weight of 0.2 gm of fresh leaves was taken and cut into several small pieces by scissors and ground in a ceramic mortar by adding 20 ml of 80% acetone until it became a color The precipitate is free of green dye, then the filtrate was separated from the sediment using a centrifuge at 3000 rpm / 10 minutes, then the extract was collected in volumetric tubes covered with opaque paper in order to block the light from chlorophyll to prevent photo-oxidation of the dye. The volume was completed by adding acetone, then the optical density of the filtrate was measured. Absorbance using a spectrophotometer type UV-1700 at wavelengths 645 and 663 nanometers, the total chlorophyll concentration was estimated according to the following equation :

Total chlorophyll={ 20.2 (D 645)+ 8.02 (D 663)}xV/Wx 1000

As V: the final volume of the filtrate after completing the separation process by the centrifuge.

D.O: Optical density reading of the extracted chlorophyll.
W: the fresh weight of the sample.

Results and Discussion

Vegetative characteristics:

Average leaf length (cm)

It is noticed from Table (2) that there was a significant superiority in the addition of treatments. The nano-fertilizer to the soil in the characteristic of average leaf length, the treatment at the concentration was 1.5 ml. liter^{-1}. palm^{-1}.The highest average was 3.39 cm, as measured by the control treatment, which gave the lowest measure of 3.11 cm .With regard to the effect of spraying with algae fertilizer for the same characteristic, also it was a (significant differences, as The treatment with 2.5 ml . liter^{-1} . palm^{-1}. The highest average was 3.30 cm compared with control treatment it gave a least significant differences measured 3.16 cm. As for the interaction between the addition of nano-fertilizer and spraying With Algae fertilizer, it was noticed that there was a significant effect on the average leaf length characteristic, as the treatment outperformed at a concentration(1.5 ml. liter$^{-1.}$ palm^{-1} Nano Fertilizer +2.5 ml. liter^{-1} . palm^{-1} algae fertilizer). It gave its largest measurement of 3.49 cm, followed by the treatment with a concentration of (1.5 ml. liter$^{-1.}$ palm^{-1} nano fertilizer +2.0 ml. liter^{-1} . palm^{-1} algae fertilizer), which measured 3.40 cm while the treatment was recorded The lowest measurement during the experiment was 3.00 cm.

Table (2): The effect of adding nano-fertilizer to the soil and spraying with algae extracts on fronds. The date palm and the interaction between them in the average leaf length (frond) (cm) for the date palm Khastawi variety

Nano fertilizer	Seaweed extracts				Average
	0	1.5	2.0	2.5	
0	3.00	3.10	3.13	3.20	3.11
0.5	3.17	3.13	3.24	3.24	3.20
1	3.17	3.23	3.28	3.27	3.24
1.5	3.29	3.36	3.40	3.49	3.39
L. S. D interaction	**0.08**				L.S. D nano fertilizer
Average	3.16	3.21	3.26	3.30	**0.04**
L. S. D seaweed extracts	**0.04**				

Leaf length average (cm)

The results of Table (3) for the treatment of palm trees with nano-fertilizer show significant differences in both treatments 1.5 and1.0 ml. liter^{-1}. palm^{-1} respectively, which reached the size of the leaf the khussa in it (50.83 and 49.67) cm, while the control treatment measurement was (47.00) cm. The results of Table (3) show that there are significant differences in the experimental parameters when spraying with

fertilizer. Algae fertilizer, where the highest measure of leaf length (Alkhassa) when treated with concentration) with 2.5 ml. liter$^{-1.}$ palm^{-1} which reached 51. 83 cm, followed by a concentration of 2.0 ml. liter$^{-1.}$ palm in that treatment I reached the average size of the leaf (the tuft) is 50. 08 cm, as measured by the control treatment, which was 44. 92 cm. The results also show the effect of the overlap between the treatments on the average (leaf) length, as We notice significant differences in most of treatments of the experiment, where the maximum measure of interaction was reached when the treatment at a concentration(1.5 ml. liter$^{-1.}$ palm^{-1} Nano Fertilizer +2.5 ml. liter$^{-1.}$ palm^{-1} algae fertilizer Algae compost which reached 55.00 cm followed by each treatment with a concentration of (1.5 ml. liter$^{-1.}$ palm^{-1} Nano Fertilizer +2.0 ml. liter$^{-1.}$ palm^{-1} algae fertilizer and (1.0 ml. liter$^{-1.}$ palm^{-1} Nano Fertilizer +2.5 ml. liter$^{-1.}$ palm^{-1} algae fertilizer) Algae fertilizer the measurement of the leaf (Al-Khosa) in it was 52.00 and 51.67 cm, as measured by the control treatment, which was explained 42.00 cm [10] that the treatment of palm offshoots of the Barhi cultivar The extract of seaweed Anfazyme led to a significant increase in the number and length of the fronds, the number of wickers, their length and width, as well as a significant increase in the number of buds. and that Fertilization with different concentrations of nano-fertilizer had a significant effect on growth, and the reason may be attributed to it.

Table (3): The effect of adding nano-fertilizer to the soil and spraying with algal extracts on fronds. The palm and the interaction between them in the average leaf length (the khussa) (cm) for the date palm of the Khastawi cultivar

Nano fertilizer	Seaweed extracts				Average
	0	1.5	2.0	2.5	
0	42.00	45.00	49.00	52.00	47.00
0.5	44.00	46.00	48.33	48.67	46.75
1	47.00	49.00	51.00	51.67	49.67
1.5	46.67	49.67	52.00	55.00	50.83
L. S. D interaction	**2.26**				L.S. D nano fertilizer
Average	44.91	47.41	50.08	51.83	**1.13**
L. S. D seaweed extracts	**1.13**				

Leaf fresh weight average (gm)

The results shown in Table (4) show that the treated palm trees by adding nano-fertilizer to1- Soil has significant differences, as the treatment gave a concentration of 1.5 and1.0 ml. liter$^{-1.}$ palm^{-1} weight rat The freshness of the leaf (khassa) reached 41.19 and 40.10 gm respectively, compared to the control treatment, which 39.59 gm reached And that the treatment of palm trees of the Khastawi variety by spraying with algae fertilizer had a significant effect as1- It gave the highest rate of fresh weight

of the leaf (khassa) when treated with a concentration of 2.5 ml . liter$^{-1.}$ palm$^{-1.}$ at a rate of 44.06 gm followed by the treatment with a concentration by 42.54 gm while it gave The comparison treatment had the lowest average fresh weight of the leaf (the tuft) which was 34.25 gm The same table showed that the overlap between the transactions has significant differences, as most of the transactions were recorded significant differences, and the highest value was for the two treatments, with a concentration of 1.5 ml . liter$^{-1.}$ palm^{-1} Nano Fertilizer +2.5 ml. liter$^{-1.}$ palm^{-1} algae fertilizer moss fertilizer (1.0 ml. liter$^{-1.}$ palm^{-1} Nano Fertilizer +2.5 ml. liter$^{-1.}$ palm^{-1} algae fertilizer with the same value, which amounted to 44.63 gm followed by(1.0 ml. liter$^{-1.}$ palm^{-1} Nano Fertilizer +2.0 ml. liter$^{-1.}$ palm^{-1} algae fertilizer which amounted to (43.43) gm as measured with the comparison treatment, which gave a value of 32.40 gm.

Table (4): The effect of adding nano-fertilizer to the soil and spraying with algae extracts on fronds.The date palm and the interaction between them in the average fresh weight of the leaf (Alkhassa) (gm) for date palm cultivar Khistawi

Nano fertilizer	Seaweed extracts				Average
	0	1.5	2.0	2.5	
0	32.40	39.80	42.57	43.60	39.59
0.5	34.60	38.43	41.50	43.37	39.48
1	32.50	39.83	43.43	44.63	40.10
1.5	37.50	39.97	42.67	44.63	41.19
L. S. D interaction	**1.45**				L.S. D nano fertilizer
Average	34.25	39.51	42.54	41.06	**0.72**
L. S. D seaweed extracts	**0.72**				

Percentage of dry matter in the leaf (Alkhasa) (%)

The results in Table (5) show that the ground treatment with nano-fertilizer has a significant effect in increasingThe percentage of dry matter in the leaves reached the highest percentage of dry matter when treated Concentration (1.5) ml.L^{-1}.palm. It reached 56.62%, while the control treatment showed the lowest percentage The dry matter was valued at 53.02%, and spraying with algae fertilizer had a significant effect on Increasing the percentage of dry matter in the leaves, as it reached the highest percentage of dry matter when treated Concentration (2.5) ml.L^{-1}. palm. It reached 56.96%, while the control treatment showed the lowest percentage For the dry matter, which amounted to 49.83 %, it is also noted that there was a significant increase in the percentage of the Dry leaves in leaves as a result of the interaction between the two nano fertilizers and algae fertilizers, especially the treatment at a concentration(1.5 ml .L^{-1}.palm^{-1}. Nano Fertilizer + 2.5 ml. L^{-1}. palm^{-1} algae fertilizer)

which was recorded A percentage of 60.20% was followed by the treatment with a concentration of (1.5 ml. L^{-1}. $palm^{-1}$. Nano Fertilizer + 2.0 ml. L^{-1}. $palm^{-1}$ algae fertilizer) the value was 58.60 %, while the comparison treatment showed less percentage of dry matter in the leaves was 49.90 %. The reason for the increase in the percentage of dry matter may be attributed to the increase in the content of leaves from Carbohydrates, or that the increase in the percentage of dry matter in the leaves may be This is due to the transfer of elements directly to the plant parts, causing an increase in carbohydrates and thus an increase in the concentration of chlorophyll pigment in the leaves was obtained causing an increase in the manufacture of carbohydrates These results agree with what was obtained by [11] in his study on date palm Al-Sayer class.

Table (5): The effect of adding nano-fertilizer to the soil and spraying with algae extracts on fronds. The palm and the interaction between them in the percentage of dry matter in the leaf (Alkhassa) (%) for date palm Kestawi class

Nano fertilizer	Seaweed extracts				Average
	0	1.5	2.0	2.5	
0	49.90	53.23	53.77	55.20	53.02
0.5	46.77	53.70	55.80	56.13	53.10
1	50.40	54.10	56.10	56.30	54.22
1.5	52.27	55.40	58.60	60.20	56.62
L. S. D interaction	**2.39**				L.S. D nano fertilizer
Average	49.83	54.11	56.07	56.96	**1.19**
L. S. D seaweed extracts	**1.19**				

Total chlorophyll pigment in the leaves (mg .gm^{-1} soft weight)

The results in Table (6) show that the two fertilizers have a significant effect on the chlorophyll content of the leaves. If the treatment exceeded the concentration (1.5 ml . $liter^{-1}$. $palm^{-1}$) The nano fertilizer is significant in increasing the content Leaves of chlorophyll, which amounted to 12.17 mg . gm^{-1} followed by the treatment with a concentration of (1 ml . L^{-1} . $palm^{-1}$) As the content of the leaves of chlorophyll was 12.07 mg . gm^{-1} when i registered The control treatment had the lowest value of 11.36 mg .gm^{-1} While spraying with algae fertilizer had the most effect on chlorophyll pigment which was recorded Treatment with a concentration of (2.5 ml .L^{-1} . $palm^{-}$ a value of 12.56 mg . gm^{-1} Followed by a significant difference Treatment with a concentration of (2.0 ml . $liter^{-1}$. $palm^{-1}$ which amounted to 12.15 mg . gm^{-1} When I registered a transaction The comparison is less valuable than the total chlorophyll content of the leaves, as it reached 11.03 mg .gm^{-1} The results showed that the moral effect of the interference was clear in the light of the superiority of the transactions and the particularity Interference coefficients concentration (1.5 ml. $liter^{-1.}$ $palm^{-1}$

Nano Fertilizer + 2.5 Fertilizer algae) concentrated (1.0 ml . liter$^{-1.}$ palm^{-1} Nano Fertilizer + 2.5 Fertilizer algae moss fertilizer) Which recorded the highest amount of chlorophyll12.89 and 12.78 mg.g^{-1}. Straight apart from a transaction the comparison that gave the lowest content of 10.78 mg. g^{-1} and may be the reason for the increase in concentration The total chlorophyll pigment in the leaves indicates the effect of these elements on the bio-building processes. Nitrogen plays the largest role in building the ring porphyrin, which is involved in building Chlorophyll molecule, while phosphorous has a auxiliary role in the formation of amino acids and proteins.And the task in building green plastids, as well as the role of potassium, which contributes to Activation of many enzymes involved in the formation of chloroplasts [12] These results are in agreement.

Table (6): The effect of adding nano-fertilizer to the soil and spraying with algae extracts on palm fronds and the interaction between them on the chlorophyll content of the leaves (wickers) of date palm Kestawi cultivar

Nano fertilizer	Seaweed extracts				Average
	0	1.5	2.0	2.5	
0	10.78	10.84	11.73	12.12	11.36
0.5	10.84	11.57	11.58	12.46	11.61
1	11.16	11.73	12.60	12.78	12.06
1.5	11.34	11.79	12.67	12.88	12.17
L. S. D interaction	**0.23**				L.S. D nano fertilizer
Average	11.03	11.48	12.14	12.56	**0.11**
L. S. D seaweed extracts	**0.11**				

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