Effect of adding NPK fertilizer ,distance and date of fertilizing on some chemical leaves characteristics and yield of date palm Cv.

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Summary

A factorial experiment was conducted in one of the date palm horticulture stations of the Ministry of Agriculture for the purpose of studying the effect of adding N.P.K. fertilizer with different distances, timing and concentrations in growth and yield for date palm trees of the Zahdi cultivar, three factors were used in the experiment after selecting 54 palm trees. The first factor included two spaces for feeding trees with fertilizer (100 and 200) cm, symbolized (A1 and A2). While he applied three dates for preparing fertilizer (3/10/2021, 3/12/2021, and 3/2/2022) symbolized (B1, B2, and B3), while the third factor, which included three concentrations of fertilizer, which are (250:250:500 and 500:500:750) gm L^{-1} In addition to the non-fertilization treatment, it is symbolized (C1). The random block design was followed with three replications, and the averages were compared according to the least significant difference (L.S.D). At a probability level of 0.05 in analyzing the data statistically. The results of the experiment showed the superiority of the triple interaction treatment (A2B2C3) in the Leaves content of nitrogen,phosphor,potassium and carbohydrates, while the triple interaction treatment (A2B2C2) excelled in the total plant yield according to the conditions of the experiment.

Keyword: Date palm, Distances and date of fertilizing, NPK fertilizer, Zahdi cultivar

Introduction

The date palm (*Phoenix dactylifera* L.) belongs to the Arecaceae family, This order is one of the most famous plant ranks spread in hot, semi-arid and dry regions, and it is also one of the oldest cultivated trees in the world according to the Food and Agriculture Organization FAO [1]. It is one of the oldest trees known to man, which dates back to more than 4000 years BC. as the Assyrians, Babylonians, and Sumerians cared about it, and the Arab world, especially the Arabian Gulf region, is its original home [2]. The lack of interest in fertilizing palm trees leads to the depletion of nutrients to the extent that the trees become unable to produce economically unless the soil is compensated with nitrogen, phosphorus and potassium by adding fertilizers because they are necessary to increase and improve production, so palm trees require relatively large amounts of nutrients. Necessary to achieve good growth and high economic production, so fertilization is one of the important practices that increase the production of dates and improve the quality of fruits, despite the health and environmental precautions that scientific studies have indicated in recent times, but it is not possible to completely dispense with chemical fertilizers, as it still occupies The leader in plant nutrition because it contains the necessary elements for plant growth, including the major elements N.P.K. needed by the plant [3]. It is mistakenly believed that it is possible for the palm tree to produce economically in any type of soil and without the need to add fertilizers [4]. In view of the above, the study aimed to improve the parameters of yield and quality of date palm trees of the Zuhdi cultivar, with the effect of different techniques of adding fertilizer N.P.K. to agricultural soil.

Materials and Methods

A factorial experiment was carried out at one of the stations of the General Authority for Palms affiliated to Ministry of Agriculture in Babil Governorate , for the purpose of studying the effect of adding N.P.K. With different distances, dates and concentrations in growth and yield of date palm trees of the

Zahdi cultivar. 54 regularly planted palm trees were elected, with 18 palm trees for each replicate. Trees of approximately similar growth were chosen in terms of height and growth strength at the age of 25 years. Then, all service operations were carried out on them according to the need during the study period. They were also pollinated with Al-Ghanami pollin's on 3/22/2022. The experiment was designed according to the randomized complete block design, and the data were analyzed according to the statistical program GenStat 2010, and the averages were compared between the treatments using the least significant difference L.S.D. At a probability level of 5% [5].

The experiment included three factors and three replications for each treatment, such as the first factor after adding fertilizer to the perimeter of the palm tree, as the compound fertilizer was added on two levels with two processing distances (100 and 200) cm after digging 4 holes for each palm tree with a depth of 50 cm using a mechanical excavator and preparing the fertilizer by means of plastic pipes with a diameter 2 inch and 60 cm long, it was pierced by an electric drill with 7 holes at depths of (30, 40 and 50) cm, then it was covered with a perforated plastic cover and fixed in the soil at a depth of 50 cm, denoted by the symbol (A1 and A2), while three dates for fertilizer processing were applied (3/10/ 2021, 3/12/2021, and 3/2/2022) symbolized for it (B1, B2, and B3), while the fertilizer concentration included the third factor, which included three fertilizer concentrations (250:250:500 and 500:500:750) gm L^{-1}, in addition to The non-fertilization treatment is symbolized (C1) by two batches for each concentration, with a one-month difference between each batch and the next. Fertilizers were prepared after mixing them and making a fertilizer mixture by dissolving them in 16 liters of water, and then injecting them into the perforated tubes located in soil around the trunk of the tree.

The following parameters were studied after the plant reached the stage of full flowering and were as follows:

1- **Leaves nitrogen content (%):** It was estimated after adding NaOH (10 M) by using a Micro Kjeldhal apparatus after calibration with hydrochloric acid (0.04 M) based on [6].
2- **Leaves phosphorous content (%):** It was estimated according to the method of [7] using ammonium molydate and ascorbic acid by the colorimetric method by Spectrophotometer at a wavelength of 882 nm.
3- **Leaves potassium content (%):** Determined according to the method of [8] using a flame photometer.
4- **leaves Carbohydrate content (%):** It was estimated according to the method of [9] by taking 200 mg of dry sample powder in a test tube and adding 8 ml of ethyl alcohol with a concentration of 80%, and it was measured by Spectrophotometer at a wavelength of 560 nm.
5- **Total yield (kg):** The weight of the total yield after the full fruiting process, according to each treatment by means of a field scale on (10/1/2022).

Results and Discussion

1/ Leaves nitrogen content (%)

The results of Table (1) showed that the distance had a significant effect on the average percentage of nitrogen in the leaves, as treatment (A2) achieved a significant superiority in this characteristic and recorded the highest average (2.716%) against (2.608%) for treatment (A1). The same table also shows that the date of adding chemical fertilizer had a significant effect on the same trait, as the treatment (B2) gave the highest average of (2.896%) and thus it was significantly superior to other treatments, and the concentration of chemical fertilizer added injected into the soil caused a significant response to this characteristic, so the treatment was recorded (C3) achieved a significant superiority by achieving an average of (3.054%), while the lowest average was recorded in the comparison treatment with an average of (2.070%).

The results of the same table show that all the binary interactions have a significant effect on the same trait. The triple interaction between the factors of the experiment (distance of adding chemical fertilizer, when it was added, and its concentration) had a significant increase in the average nitrogen in the leaves, as the treatment (A2B2C3) recorded a significant superiority in the same trait by achieving the highest average of (3.405%), while the lowest average for this trait was (1.812%) for treatment (A1B3C1).

Table (1) The effect of adding chemical fertilizers at different distances, dates, and concentrations and their interactions on the nitrogen content of the leaves (%)

distance × Date adding	)C (Concentration of Fertilizer			Date of adding) B(	distance)A(
	C3	C2	C1		
2.551	2.814	2.680	2.160	**B1**	**A1**
2.850	3.310	3.132	2.109	**B2**	
2.422	2.851	2.604	1.812	**B3**	
2.569	2.851	2.691	2.165	**B1**	**A2**
2.943	3.405	3.211	2.213	**B2**	
2.636	3.094	2.854	1.960	**B3**	
0.005	0.009			**L.S.D. 0.05**	
Average of distance	**distance × Concentration of Fertilizer**				
2.608	2.991	2.805	2.027	**A1**	
2.716	3.117	2.918	2.112	**A2**	
0.003	0.005			**L.S.D. 0.05**	
Average of Date	**Date of adding × Concentration of Fertilizer**				
2.560	2.832	2.686	2.162	**B1**	
2.896	3.357	3.171	2.161	**B2**	
2.529	2.973	2.729	1.886	**B3**	
0.004	0.007			**L.S.D. 0.05**	
	3.054	2.862	2.070	**Average of Concentration**	
	0.004			**L.S.D. 0.05**	

2/ The phosphorous content of the leaves (%)

The results of Table (2) indicate that there is no significant effect of distance on the characteristic of leaves' phosphorous content. While the date of adding the chemical fertilizer had a significant effect, as treatment (B2) gave the highest average of (0.569%) compared with the rest of the treatments. The concentration of chemical fertilizer added injected into the soil also caused a significant response, so treatment (C3) recorded a significant superiority over other treatments by achieving an average of (0.630%).

The results of the same table also showed that the interaction between the distance of adding fertilizer and the date of its addition had a significant increase in the percentage of phosphorus in the leaves in the treatment (A2B2), which was significantly superior to the other treatments and recorded the highest average of (0.571%), compared with the interaction treatment (A2B3), which recorded the lowest. an average of 0.512 (%). The interaction of the fertilizer addition distance with the fertilizer concentration also recorded a significant effect on the same trait. The treatment (A2C3) recorded the highest average of (0.630%), while the treatment (A2C1) achieved the lowest average of (0.387%). The same table shows that the

interaction of the fertilizer application date with the fertilizer concentration had a significant effect on the above trait. The treatment (B2C3) recorded the highest average of (0.663%), outperforming the other treatments.

Table (2) The effect of adding chemical fertilizers at different distances, dates and concentrations and their interactions on the percentage of phosphorus in the leaves (%)

distance × Date adding	)C (Concentration of Fertilizer			Date of adding) B(	distance)A(
	C3	C2	C1		
0.549	0.640	0.621	0.387	**B1**	**A1**
0.568	0.658	0.653	0.392	**B2**	
0.520	0.588	0.579	0.393	**B3**	
0.550	0.646	0.622	0.380	**B1**	**A2**
0.571	0.668	0.658	0.387	**B2**	
0.512	0.577	0.564	0.394	**B3**	
0.003	0.005			**L.S.D. 0.05**	
Average of distance	**distance × Concentration of Fertilizer**				
0.546	0.629	0.618	0.391	**A1**	
0.544	0.630	0.615	0.387	**A2**	
NS	0.003			**L.S.D. 0.05**	
Average of Date	**Date of adding × Concentration of Fertilizer**				
0.550	0.643	0.622	0.384	**B1**	
0.569	0.663	0.656	0.389	**B2**	
0.516	0.583	0.572	0.394	**B3**	
0.002	0.004			**L.S.D. 0.05**	
	0.630	0.616	0.389	**Average of Concentration**	
	0.002			**L.S.D. 0.05**	

As for the triple interaction between the experimental factors, it achieved a significant increase in the percentage of average phosphorus in the fruits. The treatment (A2B2C3) recorded a significant superiority in the mentioned trait by achieving the highest average of (0.668%), while the treatment (A2B1C1) gave the lowest average for this trait amounting to (0.380%).

3/ Leaf potassium content

The results of Table (3) show that the distance of addition has a significant effect on the potassium content of the leaves, as the treatment (A2) achieved a significant superiority in this characteristic and recorded the highest average of (1.707%) compared to (1.666%) for the treatment (A1). As for the time of adding chemical fertilizer It had a significant effect, as treatment (B2) gave the highest average of (1.723%) compared to treatment (B3), which recorded the lowest average of (1.623%). The concentration of fertilizer added injected into the soil caused a significant superiority, so the treatment (C3) recorded an average of (1.763%), while the lowest average for this characteristic was recorded in the comparison treatment with an average of (1.567%).

As for the interaction between the distance of fertilizer addition with the date, the treatment achieved (A2B2) significant increase in the potassium content of the leaves and recorded the highest average of (1.768%), while the treatment (A1B3) gave the lowest average of (1.609%). The interaction (A2C3)

had the highest average of (1.770%), in contrast to the treatment (A1C1), which achieved the lowest average of (1.529%), and the interaction of the date of adding fertilizer with its concentration had a significant effect on the above characteristic, so the treatment (B2C3) recorded the highest average of (1.847%), while the treatment (B3C1) achieved the lowest The average was (1.521%).

The triple interaction had a significant response, as the treatment (A2B2C3) achieved a significant superiority in this characteristic by achieving the highest average of (1.862%), while the lowest average was (1.459%) for the treatment (A1B2C1).

Table (3) The effect of adding chemical fertilizers at different distances, dates and concentrations and their interactions on the percentage of potassium in the leaves (%)

distance × Date adding	)C (Concentration of Fertilizer			Date of adding) B(	distance)A(
	C3	C2	C1		
1.712	1.748	1.743	1.644	**B1**	**A1**
1.678	1.832	1.745	1.459	**B2**	
1.609	1.687	1.657	1.483	**B3**	
1.717	1.757	1.743	1.649	**B1**	**A2**
1.768	1.862	1.836	1.606	**B2**	
1.636	1.690	1.660	1.559	**B3**	
0.004	0.007			**L.S.D. 0.05**	
Average of distance	**distance × Concentration of Fertilizer**				
1.666	1.755	1.715	1.529	**A1**	
1.707	1.770	1.746	1.605	**A2**	
0.002	0.004			**L.S.D. 0.05**	
Average of Date	**Date of adding × Concentration of Fertilizer**				
1.714	1.753	1.743	1.646	**B1**	
1.723	1.847	1.791	1.533	**B2**	
1.623	1.688	1.659	1.521	**B3**	
0.003	0.005			**L.S.D. 0.05**	
	1.763	1.731	1.567	**Average of Concentration**	
	0.003			**L.S.D. 0.05**	

4/ leaves Carbohydrate content (%)

The results of Table (4) show that the distance and date of adding chemical fertilizer and its concentration had a significant effect on the percentage of carbohydrates in the leaves, as the treatments (A2, B2 and C3) achieved a significant superiority in this characteristic amounting to (15.50, 15.75 and 16.68)%, respectively, while the treatments (A1, B3, and C1) had the lowest average (14.80, 14.49, and 12.44%), respectively.

The results of the same table show that the interaction between the addition of fertilizer and the date of its application had a significant effect on the trait. A significant increase was recorded in the average percentage of carbohydrates in leaves when treatment (A2B2) gave (16.03%), while treatment (A1B3) gave the lowest average of (13.84%). The interaction of the distance of adding fertilizer with its concentration was significant, so the treatment (A2C3) recorded the highest mean of (16.91%), significantly

superior to other treatments. The overlap of the time of adding fertilizer with its concentration had a significant effect on the above trait, so the treatment (B2C3) recorded the highest mean of (17.90%), outperforming the other treatments.

As for the triple interaction between the experiment factors, the treatment (A2B2C3) achieved a significant superiority in the aforementioned characteristic by achieving the highest average of (18.08%), while the lowest average was (11.34)% when the triple overlap treatment (A1B3C1).

Table (4) Effect of adding chemical fertilizers at different distances, dates and concentrations and their interactions on the percentage of carbohydrates in the leaves

distance × Date adding	)C (Concentration of Fertilizer			Date of adding) B(	distance)A(
	C3	C2	C1		
15.10	16.28	16.13	12.88	**B1**	**A1**
15.47	17.72	17.19	11.52	**B2**	
13.84	15.36	14.80	11.34	**B3**	
15.32	16.73	16.43	12.82	**B1**	**A2**
16.03	18.08	17.74	12.27	**B2**	
15.15	15.93	15.73	13.78	**B3**	
0.03	0.06			**L.S.D. 0.05**	
Average of distance	**distance × Concentration of Fertilizer**				
14.80	16.45	16.04	11.91	**A1**	
15.50	16.91	16.63	12.96	**A2**	
0.02	0.03			**L.S.D. 0.05**	
Average of Date	**Date of adding × Concentration of Fertilizer**				
15.21	16.50	16.28	12.85	**B1**	
15.75	17.90	17.46	11.89	**B2**	
14.49	15.64	15.27	12.56	**B3**	
0.02	0.04			**L.S.D. 0.05**	
	16.68	16.34	12.44	**Average of Concentration**	
	0.02			**L.S.D. 0.05**	

5/ Total yield (kg)

The results of the statistical analysis in Table (5) show that there is no significant effect of the distance on the mean of the total yield. While the date of adding chemical fertilizer had a significant effect on the same trait, as treatment (B2) gave the highest average of (112.8 kg) without differing significantly from treatment (B1), which achieved an average of (108.1 kg) compared to treatment (B3), which recorded The lowest average was (74.9 kg). The concentration of chemical fertilizer added injected into the soil caused a significant response to the aforementioned characteristic, so treatment (C3) recorded a significant superiority over other treatments by achieving an average of (115.0 kg), to outperform only the control treatment without significantly differing with treatment (C2), which recorded an average of (109.5 kg), while the lowest mean for this trait was recorded in the control treatment with an average of (71.3 kg).

The results of the same table also show that the interaction of the distance of fertilizer with the time, the interaction of the distance of

fertilizer application with the concentration of fertilizer, and the interaction of the time of application of fertilizer with the concentration of fertilizer, a significant increase in the average percentage of the total yield, as the binary interaction treatments (A2B2), (A2C3) and (B2C3) gave. Significant increase over the other treatments amounted to (117.6, 117.3 and 135.8) kg, respectively, while the treatment (A2B3) and the two treatments (A1C1 and A2C1) and treatment (B3C1) gave the lowest average of (73.1 kg) and (71.3 kg) for both, and an average Has a total of (67.1) kg respectively.

As for the triple interaction between the factors of the experiment combined (distance of adding chemical fertilizer, time of addition, and its concentration), it achieved a significant increase in the average percentage of the total yield, as the treatment (A2B2C2) recorded a significant superiority in the same characteristic by achieving the highest average of (143.7 kg), while it reached The lowest mean for this trait was (64.0) kg when the treatment (A1B3C1).

Table (5) Effect of adding chemical fertilizers at different distances, dates and concentrations and their interactions on total yield (Kg)

distance × Date adding	**)C (Concentration of Fertilizer**			**Date of adding) B(**	**distance)A(**
	C3	**C2**	**C1**		
107.3	125.3	117.0	79.7	**B1**	**A1**
108.0	131.7	122.0	70.3	**B2**	
76.7	81.0	85.2	64.0	**B3**	
108.8	133.2	119.0	74.3	**B1**	**A2**
117.6	139.8	143.7	69.3	**B2**	
73.1	79.0	70.0	70.2	**B3**	
13.01	22.54			**L.S.D. 0.05**	
Average of distance	**distance × Concentration of Fertilizer**				
97.4	112.7	108.1	71.3	**A1**	
99.8	117.3	110.9	71.3	**A2**	
NS	13.01			**L.S.D. 0.05**	
Average of Date	**Date of adding × Concentration of Fertilizer**				
108.1	129.2	118.0	77.0	**B1**	
112.8	135.8	132.8	69.8	**B2**	
74.9	80.0	77.6	67.1	**B3**	
9.20	15.94			**L.S.D. 0.05**	
	115.0	109.5	71.3	**Average of Concentration**	
	9.20			**L.S.D. 0.05**	

The significant response achieved in the studied parameters (subject of research) shown in Tables (1-5) may be attributed to the role of the compound fertilizer in supplying the necessary elements needed by the plant during its growth and yield formation, as supplying the trees with fertilizers during the autumn months leads to the fact that the plant is bitter In a stage of stress as a result of his formation of the previous year's achievement, and this was achieved in the second date 12/3, which achieved the highest studied results [10]. This

is consistent with what was indicated by [11] in a study on the effect of the date of adding nitrogen fertilizer (February, March and April) and the concentration of fertilizer (2.5 and 5) gm, seedlings-1 on trees of three varieties of date palm, which led to a significant increase in the studied physical characteristics. . The compound fertilizer, especially at its second concentration 500:500:750, also plays the role of these elements in organizing and stimulating the vital and physiological processes that take place during the life cycle of the plant and its main role in activating enzymes, forming proteins and nucleic acids, synthesizing fats, enzymatic conjugates, energy compounds and cytochrome necessary in the processes of photosynthesis. And respiration, as well as the construction of chlorophyll pigments and the synthesis of the amino acid Tryptophan, which has a direct role in the synthesis of auxin IAA, being the initiating compound in cell division and elongation, as well as the fertilizer treatments containing a set of necessary and sufficient nutrients to effectively contribute to the process of cell division and growth [12 and 13], Also, the treatment of palm trees with chemical fertilizer helped to achieve a state of balance in the nutrients, specifically the elements of nitrogen, phosphorus and potassium, which have a fundamental role in increasing the efficiency of most metabolic processes such as photosynthesis, respiration and building carbohydrates. In the process of filling the fruits, making them a center of withdrawal of nutrients, and thus increasing the content of the leaves of macro elements and carbohydrates, and this was directly reflected in increasing the yield of the plant [14].

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