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To cite this article: H J Murad and A F Al-Dulaimy 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **904** 012065

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Effects of Spraying with Urea and Seaweed Extract (*Tecamin Algae*) on Growth and Chemical Content of Date Palm Tree Cv. Zahdi

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Abstract. The following study was conducted in a private date palm orchard in the area of AlFurat, district of Heet throughout the season of 2019-2020 on 20-year-old date palm trees, Zahdi cultivar. The purpose was to study the effects of spraying the Urea compound with concentrations of (0, 1 and 2 g L⁻¹) as well as seaweed extract (*Tecamin Algae*) with (0, 2 and 4 g L⁻¹) of concentration on the growth and chemical content of the trees. 27 date palms were randomly selected. A factorial experiment with RCBD design was carried out such that it includes 9 treatments with 3 replicas for each treatment. Each tree was treated as one experimental unit. The results demonstrated that treatments of Urea spraying, especially with 2 g L⁻¹ concentration, contributed to achieving the best results for response measurements (Leaf Area, Total Chlorophyll, Total Carbohydrates in the Leaflets, Nitrogen, and Phosphorous), which were (2.61 m², 10.65 mg g⁻¹, 7.46%, 1.69% and 0.40%), respectively. The content of phosphorous in the leaflets was not significantly affected when sprayed with Urea. On the other hand, seaweed extract spraying had a significant effect on all the response measurements. The 4 ml L⁻¹ concentration gave the highest figures for our responses (total chlorophyll 10.38 mg g⁻¹, Carbohydrates 7.52%, Nitrogen 1.65%, Phosphorus 0.37% and Potassium 0.67%). The concentration of (2 ml L⁻¹) gave the largest area of the leaf at 2.63 m².

1. Introduction

Date palm (*Phoenix dactylifera* L.) belongs to palmae order and Family Arecaceae. The date Palm tree has an important value especially in the desert areas and oases due to its distinct morphology, which gave it the ability to adapt in those harsh climate areas [1]; [2]. In Iraq the number of date palm trees in 2018 is around (15,139,076). The total amount of date fruit produced was 639.3 thousand Tons in 2019. The Zahdi is the main variety among those other varieties of palm trees in Iraq and it contributes to 52.2% of the total production in the country [3]. Providing fertilizer through the vegetation of the plant improves the fertilization efficiency, in addition to reducing the loss of fertilizers and reduces the fixation of added elements [4]. Leaf spraying is considered a complementary method for ground fertilization and it is used because of many conditions pertinent to the soil such as soil salinity, high content of lime, and the increasing acidity of the soil. Leaf spraying is also used when roots are infected with diseases, fungi, or nematodes. Adding fertilizing elements to the soil during the high



demand for water results in the loss of large amounts of fertilizers especially the nitrogen ones, as they will be converted into nitrates that are easily moving through the soil [5].

Throughout the research and studies, it became clear that it is vital to fertilize date palm trees despite which type to use, organic or chemical fertilizer to enhance the vegetation for palm trees thereby reaching the highest productivity and quality. A few studies about the nutrition of date palm trees were carried out that simulate the conditions of Anbar province. Therefore, this study was carried out to improve the vegetative growth and the chemical content for Zahdi cultivar of palm trees through spraying with Urea and Seaweed extract, and to lower the excessive cost of adding those fertilizers to the soil through spraying of this fertilizers to the vegetative parts of trees, This will eliminate the issues accompanying adding those nutrients directly into the soil.

2. Materials and Methods

This study was conducted in one of the private date palm orchards in the area of Al-Furat about 35 km from Ramadi city, district of Heet throughout the season of 2019-2020 on 20-year-old date palm trees, Zahdi cultivar. The study was conducted using 27 homogeneous trees with a unified number of leaves and fruit clusters. All agricultural operations of animal fertilization, control, irrigation (well water irrigation, table 1). An analysis of the chemical and physical contents of orchard's soil are shown in table 2.

Table 1. Some chemical properties of water.

Na ⁺ Mq L ⁻¹	Mg ⁺⁺ Mq L ⁻¹	Ca ⁺⁺ Mq L ⁻¹	EC ds m ⁻¹	pH
0.41	21.50	30.50	5.79	7.87
SO ₄ ⁼ Mq L ⁻¹	Cl ⁻ Mq L ⁻¹	HCO ₃ ⁼ Mq L ⁻¹	CO ₃ ⁼ Mq L ⁻¹	K ⁺ Mq L ⁻¹
37.86	22.86	2.60	Nil	0.78

Table 2. Some chemical and physical properties of soil.

P Av. mg Kg ⁻¹	Total N %	CaCO ₃ g Kg ⁻¹	Bulk density g cm ⁻³	O.M %	EC ds m ⁻¹	pH
1.05	0.13	136.44	1.25	1.07	3.52	7.80
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	K Av. mg Kg ⁻¹
36.62	4.00	Nil	0.40	31.20	46.80	151.14
Texture			Clay g Kg ⁻¹	Silt g Kg ⁻¹	Sand g Kg ⁻¹	SO ₄ ⁼ Mq L ⁻¹
Sandy loam			20.0	396.0	584.0	42.52

A two-factor experiment (3×3) with Random Completed Block Design (RCBD) as the experiment contained 9 treatments and three replications (one tree per replication) thus the total number of trees used in the experiment as (27 trees). Two factors were used, urea spraying with concentrations of (0, 1 and 2 g L⁻¹) and seaweed extract (Tecamin Algae) with concentrations of (0, 2 and 4 ml L⁻¹). The extract consisted of (7% organic matter, 0.1% Nitrogen, 0.15% Phosphorous (P₂O₅) and 0.25 K₂O%). The operation of spraying was done three times for both factors (at the beginning of hababouk stage, after 30 days of the first spray round, and after 30 days of the second spray round). The data were statistically analyzed and the medians were compared using the Least Standard Difference analysis (LSD) with a 5% significance [6]. The analysis was carried out using Genstat software.

Our response measurements were leaf area [7], total chlorophyll in the leaflets [8], percentages of total carbohydrates in the leaflets[9], and percentages of Nitrogen, Phosphorous, and Potassium in the leaflets [10].

3. Results and Discussion

3.1. Leaf Area (m^2)

Urea spraying A2 showed a significant difference in the leaf area compared to A0 and gave the highest value at $2.61 m^2$, whereas the treatment A0 gave the least value $2.37 m^2$ that has no significant difference compared to A1, Figure 1A. The effect of spraying seaweed extract was significant especially at B1, which was significantly different from B2 and B0 and gave the highest value of leaf area at $2.63 m^2$; whereas B0 treatment gave the least value at $2.35 m^2$. The two-factors interaction gave a significant effect especially the treatment A2B1 that gave the highest value at $2.86 m^2$ compared to the treatment A0B0 that gave the least value at $2.24 m^2$.

3.2. Total Chlorophyll ($mg g^{-1}$)

Urea spraying had a significant effect on chlorophyll content in the leaflets, especially A2 which gave the highest value at $10.65 mg g^{-1}$. On the other hand, the treatment A0 (no urea spraying) gave the least value at $8.83 mg g^{-1}$ which was not significantly different compared to A1, Figure 1B. Similarly, Seaweed extract spraying gave us the highest significant results with B2 at $10.38 mg g^{-1}$ compared to the lowest value from B0 at $9.16 mg g^{-1}$, which is no significant compared to B1. As for the interaction of the two factors, the significant effect was clear at A2B1 where the highest value was achieved, $11.82 mg g^{-1}$, compared to A0B0, which has the lowest value at $7.31 mg g^{-1}$.

3.3. Carbohydrates percentage

The results in figure 1C show that urea treatment caused a significant increase in the content of carbohydrates in the leaflets. The percentage was the highest with the treatment A2 at 7.46%, which is significantly different compared to A0 which gave the lowest value at 6.58% and this treatment was not significant compared to A1. Seaweed extract spraying was also significant at B2, which gave the highest value 7.52%. It was not significantly different from B1. On the other hand, B0 gave the lowest value 6.56% which wasn't significantly different from B1. The interaction of the treatments was significant and gave the highest value at A2B2, 8.25%, whereas the lowest value was achieved with A0B0, 6.12%.

3.4. Nitrogen Percentage

Statistical data refers that spraying nitrogen in the form of urea gave a significant effect on the percentage of nitrogen in the leaflets (figure 1D). The highest level of the treatment A2 was significantly different and gave a higher value 1.69% compared to A0 which gave a lower percentage of 1.48% which was not significantly different from A1. Seaweed spraying showed a superiority of the two treatments (B1, B2) which gave higher values (1.64%, 1.65%) compared to B0 (no spraying), which recorded a lower value at 1.49%. The interaction of the two treatments gave significant values where the treatment A2B2 gave the highest value, 1.84% and the lowest value recorded was 1.38% with the treatment A0B0.

3.5. Phosphorous Percentage

Urea spraying showed a significant effect on phosphorous percentage, the percentage was the highest with the treatment A2 at 0.40%, which is significantly different compared to (A0 and A1) figure 1E, whereas the lowest value was achieved with B0, 0.29%. Seaweed extract spraying was significant when using the highest level of treatment B2, which was significantly different, compared to (B1, B0) and gave a value of 0.37%. Phosphorous percentage was at a lower value at B0 0.30% which was not significantly different from B1. The binary interaction reached a significant difference at the highest level of treatments A2B2 which gave a value of 0.46% compared to the standard's treatment value A0B0 0.23%.

3.6. Potassium Percentage

The results shown in figure 1F indicate that urea spraying did not reach significance regarding potassium content in the leaflets of the date palm trees. On the other hand, seaweed extract showed a significant difference between the treatments especially B2 which gave a high value of 0.67%, which was not significant compared to B1. However, the standard treatment B0 gave a lower value of potassium content at 0.56%. The interaction of treatments gave the highest value for potassium content with the treatment A2B2 which gave about 0.71% with an increase of about 33.96% compared to the standard units A0B0 which gave the lowest value of potassium content, 0.53%.

Urea spraying effect on the increase of the traits is due to the high content of nitrogen (46%) which is one of the primary elements needed. It contributes to the growth of the vegetation and roots [11]. It is also a primary component for the cell's protoplasm after water. It covers approximately about (2-4%) of the plant dry matter. It is also part of the essential organic compound such as the amino acids, nucleic acids (DNA, RNA) as well as botanical enzymes and hormones [12]. It is also a fundamental part of the formation of the green dye (Chlorophyll) in photosynthesis, thereby granting the green color for the plant. It is required for the formation of porphyrin units for chlorophyll, and 70% of leaves nitrogen participates in the formation of chlorophyll [13]. Urea is considered one of the most suitable nitrogen sources for addition to the leaves due to the high speed of absorption and transference, non-polarity, and low poisoning depend of plant species [14]; [15]. Besides, nitrogen has great importance throughout the different stages of fruit growth, as it can be part of proteins, as well as the genetic metabolites [16]. It is also part of the energy transference compounds such as Adenosine Tri-Phosphate (ATP), which encourages metabolism inside the plant [17]. Plants with a minimal amount of Nitrogen will be small-sized, weak, and give a low production amount [18].

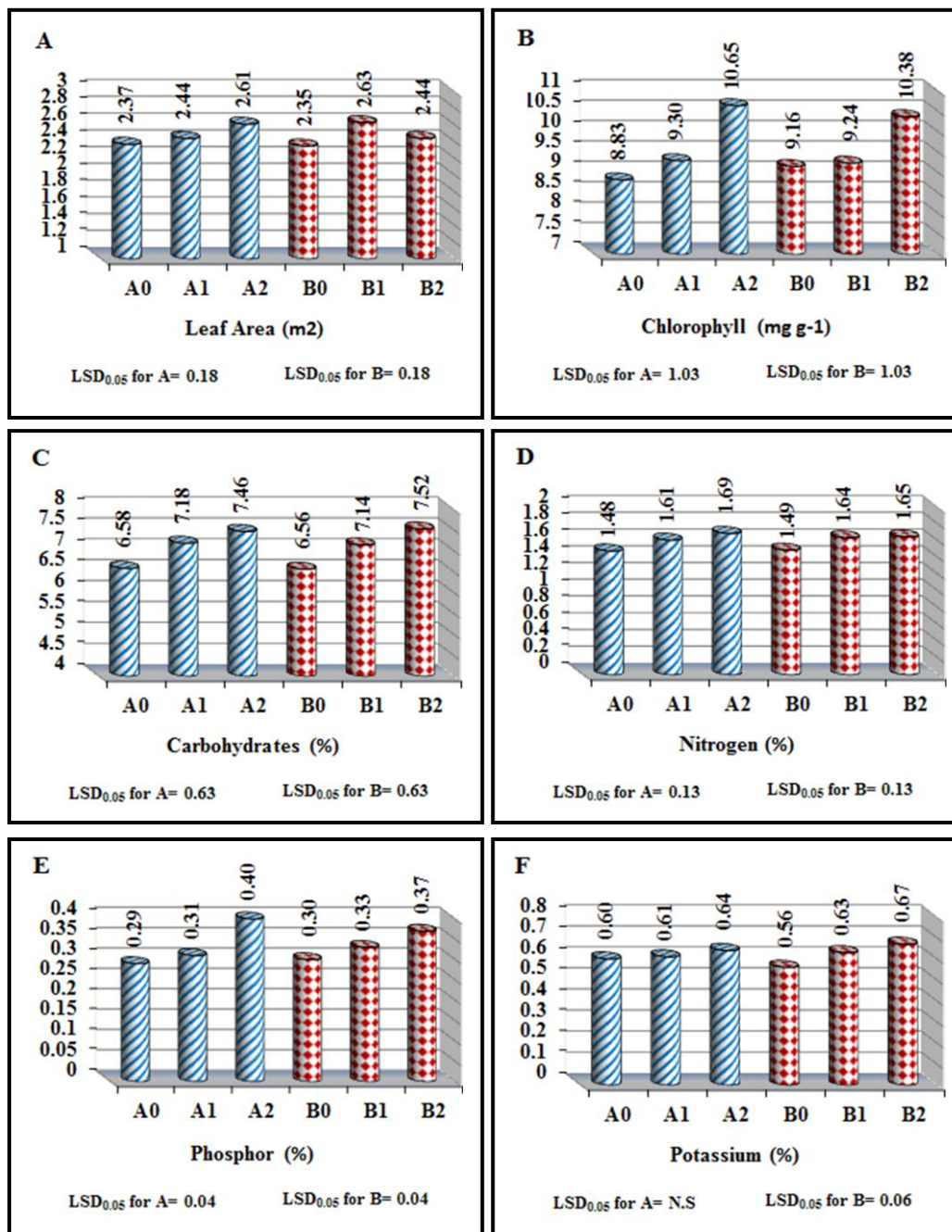
The seaweed extract (Tecamin Algae) has a positive effect in improving the traits of the growth and chemical content is due to the content of that extract including the organic matter and the essential nutrition such as potassium, phosphorous, and nitrogen. The metal elements affect directly or indirectly the process of carbon dioxide fixation in the green cells by activating some enzymes pertinent to photosynthesis. This reflects new cells and tissue growth and formation. The monosaccharides that are directly produced from photosynthesis are considered the backbone of the structure of different plant tissues. Also, building new cells requires cell divisions and that depends primarily on building nucleic acids and proteins. This process needs energy units (ATP) produced from photosynthesis and respiration [19].

Phosphorous plays a vital role in carbohydrate metabolism and helps in the formation of amino acids and essential proteins for building chlorophyll. It also helps in building the Meristematic tissues, division of living cells, photosynthesis and material transfer resulting from it, and activation of enzymatic systems [20]; also, it plays an important role in the formation of other compounds such as carbohydrates, Phospholipids, and co-enzymes, which are vital in metabolism. Thus, the vegetation growth will be increased which has a positive effect on productivity [21].

Potassium also makes a vital role in stomata open-close mechanism, nitrate reduction inside the plant, stimulation of cell division, increasing of cellulose and lignin formation, and assistant of transference of saccharides and starch among different parts of the plant, not to mention its role in the growth and evolution of the modern tissues [22]. Potassium also causes low osmotic pressure in the cell, which enables it to draw water, then increasing the growth of the leaf, i.e enlarge surface area [23]. It also contributes to activate different physiological processes such as chlorophyll formation and production of hydrocarbons, which stimulate all vegetation growth aspects [24]. Potassium also works as a transference for carbohydrates from the source in the leaf to the sink area in the fruit. This increases the osmotic potential inside the cells, thereby great amounts of water will be transferred into the cells increasing their size [25]. Seaweed extract contains a botanical hormone, especially auxins and cytokinins, which stimulates cell division and elongates them [26].

4. Conclusion

In conclusion, Urea and Seaweed extract (*Tecamin Algae*) spraying is an effective method in nourishing the Zahdi variety. It contributes to enhances the growth and increase of chemical content of date palm trees. Therefore, it is recommended to spraying urea and seaweed extract as a complementary and effective method for fertilization in growth-increasing and chemical content of date palm trees, Zahdi cultivar.



Urea A0= 0 g L⁻¹ A1= 1 g L⁻¹ A2= 2 g L⁻¹
 Tecamin Algae B0= 0 ml L⁻¹ B1= 2 ml L⁻¹ B2= 4 ml L⁻¹

Figure 1. Effects of spraying with urea and seaweed extract (*Tecamin Algae*) on growth and chemical content of date palm tree Cv. Zahdi.

Table 3. Effect of spraying with urea and seaweed extract (*Tecamin Algae*) interaction on growth and chemical content of date palm tree Cv. Zahdi.

Urea (g L ⁻¹)	Tecamin Algae (ml L ⁻¹)	Leaf Area (m ²)	Chlorophyll (mg g ⁻¹)	Carbohydrate s (%)	N (%)	P (%)	K (%)
0	0	2.24	7.53	6.12	1.38	0.23	0.53
	2	2.31	7.81	7.24	1.45	0.34	0.64
	4	2.56	11.15	6.38	1.61	0.28	0.62
1	0	2.33	9.70	7.10	1.59	0.27	0.58
	2	2.72	8.08	6.51	1.74	0.30	0.60
	4	2.27	10.12	7.92	1.50	0.37	0.67
2	0	2.47	10.26	6.46	1.51	0.41	0.57
	2	2.86	11.82	7.67	1.73	0.35	0.65
	4	2.50	9.87	8.25	1.84	0.46	0.71
LSD 5%		0.32	1.78	1.10	0.22	0.07	N.S

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