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# Response of Date Palms Cv. Zahdi to Foliar Spray with Urea and Seaweed Extract

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**Abstract.** This study was conducted in one of the private palm groves in Anbar governorate, Heet city, Al-Furat district during the 2019-2020 growing season on date palm trees (Zahdi cultivar), to study the effect spraying urea at a concentration (0, 1 and 2 g L<sup>-1</sup>) and seaweed algae extract at a concentration (0, 2 and 4 ml L<sup>-1</sup>). Twenty-seven of 20-year-old trees were selected. A factorial experiment was carried out in randomized complete blocks design (RCBD) included 9 treatments and 3 replications. The results showed that urea treatments especially 2 g L<sup>-1</sup> have the best yield traits (fruit weight, cluster weight, yield and reducing sugars in fruits which reached (9.62 g, 13.62 kg, 163.2 kg tree<sup>-1</sup> and 54.07%), respectively. As to 1g L<sup>-1</sup> urea gave the highest volume of fruits which is (6.43 cm<sup>3</sup>). Whereas the urea has no significant effect on the nitrate content in fruits. On the other hand, the spraying with 4 ml L<sup>-1</sup> of seaweed extract has significant effect on volume of fruits and reducing sugars that reached to the highest values of (6.21 cm<sup>3</sup> and 53.86%), respectively. While the concentration of 2 ml L<sup>-1</sup> revealed the highest cluster weight of (13.21kg and total yield of 132.1kg tree<sup>-1</sup>). Furthermore, it reduced nitrate content of fruit to the minimum level of (30.95 mg L<sup>-1</sup>).

\* Part of M.Sc thesis of the 1<sup>st</sup> author

## 1. Introduction

Date palm (*Phoenix dactylifera* L.) belongs to palmeae order and Family Arecaceae, which includes more than 200 genus and about 4000 species, and is one of the most useful plant families for man after the family of the Gramineae [1]. Palm trees occupy an important place especially in oases and deserts areas because of their distinct morphology that enabled them to adapt to these difficult climatic areas [2]; [3]. The number of palm trees in Iraq is 15139076 palm trees in 2018, and date production for 2019 was approximately 639.3 thousand tons, and Zahdi cultivar is one of the major species in Iraq, which give about 52.2% of the total production of palms in Iraq [4].

The supporting of plants with fertilizer through the total vegetative mass increases the efficiency of fertilization, as well as reducing the amount of loss fertilizer and reducing the stabilization of added elements [5].The foliar spraying is supplemental to ground fertilization which is used because of several conditions concerned with soil like high salinity, high content of lime, and high pH, and also used when the roots infection by fungus pathogens. Adding fertilizer elements to the soil during the period of high water requirements leads to the loss of quantities of fertilizers, especially nitrogen fertilizer, because they quickly turn into easy movable nitrates in the soil texture and are quick to lose [6].Urea is one of the most useful forms of nitrogen for foliar application due to its high nitrogen content, melting speed, ease of absorption, rapid transmission and low toxicity, as well as being "low-cost" compared with ground fertilizer [7]; [8]. The addition of fertilizer, particularly nitrogen, has led to a significant increase in the growth and yield of palm trees [9]; [10].

Seaweed extracts have been widely used recently to improve plant growth, increase productivity and quality, and produce crops free of chemical pollutants, as well as contains growth-encouraging



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substances such as cytokines, auxins, gibberellins, vitamins and polysaccharides, and also contains "micro- and macro nutrients, amino acids and organic acids [11].

There is still a misconception among many farmers that date palm can grow and produce without the need for fertilization, while most reports and research conducted by many researchers pointed to the need for chemical and organic fertilization of palms in order to improve vegetative growth and thus reach the best quantity and quality product, and for these reasons and due to the lack of studies on palm nutrition, especially in conditions in Anbar province, this study is implemented in order to improve the vegetative growth of the palm trees. Equipped with nutrients that thus contribute to increasing the yield qualitatively and quantitatively, as well as reducing the high cost of adding nitrogen fertilizer to the soil by using "low-spraying" on the vegetative parts of trees and stay away from the problems of adding those fertilizers directly to the soil.

## 2. Materials and Methods

### 2.1 Trial laying out

The study was conducted in one of the private palm groves in Anbar governorate, Heet city, Al-Furat district, which is 35 km west of Ramadi during the growth season 2019-2020 on the trees of date palms of a 20-year-old Zahdi cultivar, 27 homogeneous trees were selected as much as possible and then the number of palm leaves and cluster were unified. All service operations for trees have been carried out from animal fertilization (20 kg palm<sup>-1</sup> chicken manure) and irrigation (irrigation with well water whose qualities are shown in Table 1). Analyses of the chemical and physical properties of the orchard's soil are shown in Table 2.

Table (1) Some chemical properties of water

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

Table 2. Some chemical and physical properties of soil

P Av. mg Kg <sup>-1</sup>	Total N %	CaCO <sub>3</sub> g Kg <sup>-1</sup>	Bulk density g cm <sup>-3</sup>	O.M %	EC ds m <sup>-1</sup>	pH
1.05	0.13	136.44	1.25	1.07	3.52	7.80
Cl <sup>-</sup> Mq L <sup>-1</sup>	HCO <sub>3</sub> <sup>=</sup> Mq L <sup>-1</sup>	CO <sub>3</sub> <sup>=</sup> Mq L <sup>-1</sup>	Na <sup>+</sup> Mq L <sup>-1</sup>	Mg <sup>++</sup> Mq L <sup>-1</sup>	Ca <sup>++</sup> Mq L <sup>-1</sup>	K Av. mg Kg <sup>-1</sup>
36.62	4.00	Nil	0.40	31.20	46.80	151.14
Texture			Clay g Kg <sup>-1</sup>	Silt g Kg <sup>-1</sup>	Sand g Kg <sup>-1</sup>	SO <sub>4</sub> <sup>=</sup> Mq L <sup>-1</sup>
Sandy loam			20.0	396.0	584.0	42.52

A two-factor experiment (3 × 3) was carried out according to the randomized complete blocks 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). In the experiment, two factors were used, the first was urea spraying at a concentration (0, 1 and 2 g L<sup>-1</sup>) presented with symbols (A0, A1 and A2), and the second is seaweed extract "Tecamin algae" with (0, 2 and 4 ml L<sup>-1</sup>) presented with symbols (B0, B1 and B2). The seaweed extract consists of (organic matter 7%, nitrogen 0.1%, Phosphorus (P<sub>2</sub>O<sub>5</sub>) 0.15% and potassium (K<sub>2</sub>O) 0.25%. 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 measured traits are; fruit weight (g), fruit volume (cm<sup>3</sup>), cluster weight (kg), yield (kg palm<sup>-1</sup>), percentage of reducing sugars in fruits, and nitrate content in fruits (mg L<sup>-1</sup>).

### 2.2. Statistical analysis

All the data were statistically analyzed. The means were compared to the least significant difference (LSD) at 0.05 probability level. GenStat program was used for data statistical analyses.

### 3. Results and Discussion

#### 3.1. Fruit weight (g)

Figure 1A results show that urea foliar application reached the level of significance in effecting fruit weight, especially at application A2 treatment that differed significantly from A0 treatment application and gave highest value that was 9.62g, meanwhile the application A0 treatment has recorded lowest value which was 8.46g. It showed significant difference from the application A0 treatment. On the other hand, the seaweed extract and both factors interaction hasn't show significant effect in the studied trait (table 3).

#### 3.2. Fruit volume (cm<sup>3</sup>)

The results of figure (1B) show that urea foliar application caused significant increase in fruit volume to reach maximum at A1 application that is 6.43cm<sup>3</sup> which differed significantly from both (A0 and A2) concentrations applications which gave minimum values of this trait to study, they were (5.35 and 5.62 cm<sup>3</sup>), respectively. The seaweed extract effect reached the level of significance as well through giving maximum value for applications treatments (B1 and B2) which were (6.04 and 6.21cm<sup>3</sup>) and no significant difference existed between them. While the both treatments differed significantly from the B0 concentration (non-spray) that which gave minimum value 5.18cm<sup>3</sup>. The interaction between the study factors have made significant effect, especially A1B2 which reached to maximum value 6.85cm<sup>3</sup>, while the minimum fruit volume value was 4.47cm<sup>3</sup> at the A0B0(table 3).

#### 3.3. Cluster weight (kg)

The statistical data of figure (1C) refer that urea has made significant effect on cluster weight where the A2 concentration has significantly superiority on both (A0 and A1) giving maximum cluster weight 13.62kg, while the minimum value of this studied trait appeared at (A0 and A1) concentrations to reach (12.32 and 12.56kg), respectively. Also, spraying trees with seaweed extract has shown significant effect and made the applications (B1 and B2) treatments dominate significantly on the non-spray application B0 treatment and gave maximum values (13.21 and 13.10kg), respectively. While the treatment B0 has recorded minimum value 12.19kg. The interaction of both study factors has made significant effect especially at A2B1 which gave maximum cluster weight 14.82kg, while it decreased to minimum 12.01kg at A1B0 (table 3).

#### 3.4. Total yield (kg palm<sup>-1</sup>)

The urea has significant effect the total yield of dates palm through the dominance of A2 treatment on A0 and A1 giving maximum total yield 136.2 kg. The minimum values has appeared at A0 and A1 treatments to reach (123.2 and 125.6 kg), respectively without significant difference between them (Fig. 1D). The seaweed extract spray has made significant effect through the dominance of (B1 and B2) treatments on the non-spray application B0 treatment and gave maximum value (132.1 and 131.0 kg), respectively without significant difference between them, while the B0 treatment had recorded a minimum value 121.9 kg. The interaction of both study factors has shown significant effect especially at A2B1 which gave a maximum total yield of 148.2 kg and decreased to a minimum at A1B0 that was 120.1 kg (table 3).

#### 3.5. Reducing sugars (%):

The urea applications treatment has shown significant effect in the fruits reducing sugars content; especially the A2 concentration which significantly differed from the A0 concentration and made a maximum percentage that was 54.07%. On the opposite, the minimum percentage was 45.68% at the A0 concentration, which hasn't differed significantly from A1 concentration (Fig. 1E). Also, the extract spray applications have given a significant effect on this trait through the significant dominance of B2 treatment on B0 to give maximum percentage of 53.86%, while it reached to minimum percentage 46.11% at the application B0 that's not significantly different from B1 treatment. Concerning the bi-interaction, it reached the level of significant effect, especially at A1B2 which gave the highest percentage of 63.96% to achieve increasing percentage of 45.96% compared with the A0B0, in which, the fruits content of reducing sugars decreased to 43.82% (table 3).

#### 3.6. Nitrate content in fruits (mg L<sup>-1</sup>)

The statistical data in (figure 1F) suggests that urea spray hasn't made a significant effect on urea. While spraying trees with seaweed extract showed a significant effect giving the applications (B1 and B2) treatments a minimum values (30.95 and 31.83 mg L<sup>-1</sup>) to show so a significant difference from

the non-spray application B0 concentration which gave a maximum value of 37.09 mg L<sup>-1</sup>. The study factors interaction have made significant effect, especially at A2B1 which gave minimum value of 24.13 mg L<sup>-1</sup>, but the nitrate has accessed maximum level at A2B0 that is 38.31 mg L<sup>-1</sup> (Table 3).

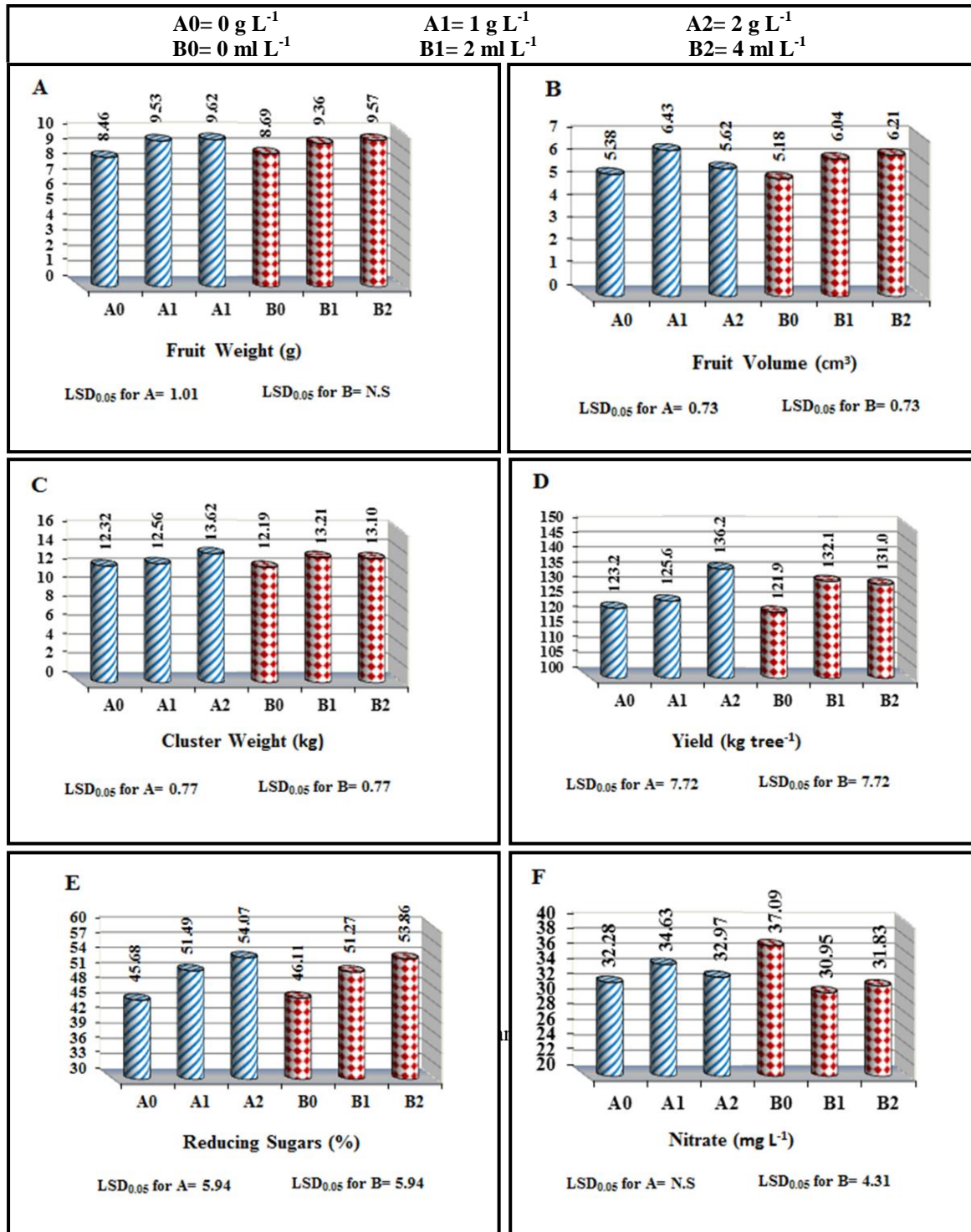


Figure 1. Yield traits affecting by sprayed urea and seaweed extract.

Table (3) Effect of foliar spray with Urea (A) and Tecamin Algae fertilizer (B) interaction on some yield traits of date palm Cv. Zahdi

Urea (g L <sup>-1</sup> )	Tecamin Algae (ml L <sup>-1</sup> )	Fruit Weight (g)	Fruit Volume (cm <sup>3</sup> )	Cluster Weight (kg)	Yield (kg)	Reducing Sugars (%)	Nitrate (mg L <sup>-1</sup> )
0	0	7.66	4.47	12.43	124.3	43.82	35.68
	2	8.51	5.05	12.35	123.5	47.71	34.12
	4	9.20	6.62	12.18	121.8	45.50	27.03
1	0	8.83	5.73	12.01	120.1	45.63	37.29
	2	9.85	6.71	12.47	124.7	44.87	34.58
	4	9.91	6.85	13.21	132.1	63.96	32.00
2	0	9.57	5.33	12.14	121.4	48.87	38.31
	2	9.72	6.36	14.82	148.2	61.24	24.13
	4	9.59	5.17	13.90	139.0	52.11	36.47
LSD <sub>5%</sub>		N.S	1.26	1.34	13.37	10.30	7.47

The urea effect on increasing crop studied traits may be due to their high nitrogen content (46%) which is a basic element that plants require because it facilitates shoot growths and strengthens root growths [12]. It is a major component of cell protoplasm after water, its percentage is (2-4%) of a plant's dry material, it enters in constructing the plant essential organic compounds like amino acids, proteins, nucleic acids (DNA and RNA), enzymes and plant hormones [13]. It is also a major chlorophyll biosynthesis component to run the photosynthesis and give plant green colour because it plays a direct role synthesizing this dye as it shares the building of porphyrins that enter its structure. 70% of leaves nitrogen participate in the chlorophyll synthesis [14]. Urea is the most suitable form of nitrogen for leaf addition being quickly absorbed, non-polarized, few toxic and high soluble [7]; [15]. As well as the nitrogen importance in the different fruit growth stages as it functions directly to build protein, metabolic and genetic compounds [16]. It also participates in forming energy kinetics like ATP to support bioactivities that occur inside a plant [17]; so, the trees with acute nitrogen deficiency are small in size and weak in growth with low yield [18]. Nitrogen also induces plants to produce auxins that support cell division and elongation [19].

About the positive effect of seaweed extract (Tecamin Algae) in the yield trait enhancement, it is due to this extract content of organic matter and other macronutrients (P, N and K); so, the mineral elements effect directly or indirectly in carbon dioxide fixation in plant green cells through activating some photosynthetic enzymes, thus it reflects somehow on plant growth and new cells and tissue generation because monosaccharides that result directly from photosynthesis are basic components in plant tissue composition. Also the new tissue formation needs cell division which mainly depends on protein and amino-acid formation that requires energy units (ATP) produced from respiration and photosynthesis [20]. Phosphorus here plays important role in carbohydrate stimulation, amino acid and protein formation to synthesize this dye. Also phosphorus plays active role to enhance meristematic tissue growth, helping living cell division, photosynthesis and its productions transports and enzymatic system activation [21], in addition to its role in energy rich compound formation which a plant needs to synthesize other compounds like carbohydrates, phospholipids and coenzymes that participate bioactivity activation and thus cause vegetative growth enhancement [22] which positive effect reflects on yield. Potassium also makes a vital role in stomata open-close mechanism, nitrate reduction in a plant, cell division and growth induction, increasing cellulose and lignin formation and helping saccharide and starch transport among plant parts, in addition to its role in the formation and growth of new tissues [23], and because of low osmosis happening in cell vacuole which enables it to draw water and then increasing leaf enlargement rate that means surface area increase. Potassium also participates enhancing different physiological processes like chlorophyll synthesis and producing a large amount of carbohydrates which enhances every type of vegetable plant growth [24]. In addition, potassium functions as a carbohydrate carrier from the manufacture area in leaf (source) to the destination centres (sink) like fruits to increase, therefore, the osmotic pressure inside cells, this is help to large quantities of water move inside cells to cause size enlargement [25]. The seaweed extract also contains plant hormones, especially auxins and cytokines that induce cell division and elongation [26].

#### 4. Conclusion:

The conclusion of study results is that spraying urea and seaweed extract (Tecamin Algae) is a vital method to feed date palms Zahdi cultivar because it participated yield increase and improvement. So, we recommend spraying urea and seaweed extract as an active and also fertility supporting method that largely enhances the yield, in addition to decrease fruit contamination with nitrate, especially at seaweed extract spray.

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