



ORIGINAL ARTICLE

THE EFFECT OF SPRAYING WITH NUTRIENT SOLUTION CALMAX AND MARINE EXTRACT STIMPLEX AND THEIR INTERACTIONS ON SOME NUTRIENTS AND TOTAL DISSOLVED CARBOHYDRATES OF DATE PALM LEAVES *PHOENIX DACTYLIFERA* L.

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Abstract: This study was conducted during 2019-2020 on date palm offshoots of *Phoenix dactylifera* L. cultivar LuLu at the Department of Horticulture and Landscape, Faculty of Agriculture and Marshlands, University of Thi-Qar, to determine the effect of spraying each of Calmax nutrient solution by three concentrations 0, 2 and 4 ml.L⁻¹ and Stimplex marine extract by four concentrations 0, 4, 8 and 12 ml.L⁻¹. The results showed that the treatment with nutrient Calmax solution has a significant increase in each of total dissolved carbohydrates and nitrogen and phosphorous and potassium where the concentration of 4 ml.L⁻¹ was the highest average, the treatment with the extract (0, 4, 8 and 12) ml liter⁻¹ a significant increase in the total soluble carbohydrates and the nitrogen component where the concentration of 12 ml liter⁻¹ achieved the highest average of 13.11 mg gm⁻¹ and 2.663%, respectively.

Keywords: Palm, Nutrient solution, Marine extract.

Cite this article

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1. Introduction

Date palm *Phoenix dactylifera* L. belongs to the family Arecaceae and the order Palmae which contains 200 genus and nearly 4000 species of date palm. The most important subspecies is the Phoenix genus, while the dactylifera type is the most important due to its high levels of sugars and varying proportions of vitamins, amino acids proteins and elements. The concept of Plant Tissue Culture provides for separating cells tissues or organs dividing them into several sections and developing them on food media in the laboratory and under sterile conditions up to the stage of complete plant formation [Omar *et al.* (1992)].

Calmax Nutrient Solution is a unique technology foliar nutrient that contains calcium and balanced proportions of magnesium, nitrogen and chelated

microelements in the form of EDTA. Issa *et al.* (2019) and Thomas *et al.* (2009) defined it as biostimulant and is known to be different materials and microorganisms used to increase and improve plant growth. Seaweed extracts contain many elements such as nitrogen, phosphorous, potassium and others and that these nutrients present in the extract work with more than one group of growth promoters such as oxins, cytokines, proteins, amino acids and antioxidants [Abdulrazzaq and Mohammed (2019), Zamani *et al.* (2013)].

2. Materials and Methods

The study was conducted at Thi-Qar University College of Agriculture and the Marshlands for the period (October 2019 - October 2020) on 36 seedlings of date palm seedlings of type (LuLu) resulting from

tissue cultivation, identical in size and age of two years, the experiment was designed according to the design of complete random sectors (RCBD) (Randomized Completely Block Design) with two factors. The first factor includes the use of three concentrations of Calmax nutrient solution, which are (0, 2 and 4) ml.L⁻¹. The second factor is spraying plants from Stimplex marine algae extract in four concentrations (0, 4, 8 and 12) ml.L⁻¹ soil was prepared by mixing a ratio (1:2:1) of soil peat moss and vermiculite, respectively and treated with the insecticide Rivadan and the fungicide Hemex 5G as a preventive to avoid insect and fungal infections and with recommended concentrations soil was placed in anvils of 35 cm diameter. The seedlings were transferred and the offshoots were irrigated before they were sprayed with the nutrient solution or marine extract.

Method of treating seedlings with solutions

The seedlings were sprayed weekly with both Calmax Nutrient Solution and Stimplex Marine Extract both separately up to complete wetness by using a hand pump and with using some drops of the diffuser material.

A. Estimation of the ion content: According to the method given in Hesse (1971).

B. Estimation of the nitrogen, phosphorous and potassium (N, P and K): Items were estimated

Table 1: Some physical and chemical properties of soil and water samples.

| Sample type | Texture | Sand % | Clay % | silt % | O.m% Organic matter | O.c Organic carbon | To.c | E.C. soil m/ds | pH soil | E.C water m/ds | pH water |
|-------------|------------|--------|--------|--------|---------------------|--------------------|-------|----------------|---------|----------------|----------|
| | Loamy sand | 84.143 | 9.514 | 6.343 | 1.513 | 0.657 | 0.877 | 0.72 | 6.99 | 0.123 | 7.53 |

at three replicates treatment.

Nitrogen: nitrogen by using a microkildal device according to the method given in Jackson (1958).

Phosphorous: Total phosphorous was estimated with a Spectrophotometer at wavelength 882 according to the method given in Page *et al.* (1982).

Potassium: As for potassium, it was estimated using the Flamephotometer according to the method mentioned in Page *et al.* (1982).

Estimation total dissolved carbohydrates

The content of total dissolved carbohydrates was estimated according to the phenol-sulfuric acid method based on Herbert *et al.* (1971).

3. Results and Discussion

Nitrogen content % leaves⁻¹

The results in Table 1 showed that the effect of the nutrient solution Calmax has a significant effect on the percentage of nitrogen in the leaves of the date palm obtained from tissue culture of the Lulu variety. The Calmax nutrient solution at a concentration of 4 ml liter⁻¹ achieved the highest average of 2.24% compared with the comparison treatment which recorded the lowest average of 1.96%. At the same time it did not differ significantly from the treatment of the nutrient solution at a concentration of 2 ml.L⁻¹.

The results in the Table 2 showed the effect of Stimplex marine extract and it had a significant effect on nitrogen concentration, as the treatment 12 ml liter⁻¹ achieved the highest average of 2.66 compared with the comparison treatment which recorded the lowest average of 1.33% and at the same time it was significantly different from the treatment of Marine extract at concentration 4 ml liter⁻¹ but it did not differ significantly from the treatment of marine extract at concentration of 8 ml.liter⁻¹. The results showed that the overlap between Calmax and Stimplex marine extract treatment are not significant.

Phosphorous content % leaves⁻¹

The results in Table 3 showed the significant effect

Table 2: The effect of spraying with nutrient solution Calmax and Stimplex seaweed extract and the interaction between them on percent nitrogen % content of leaves.

| Nutrient solution Calmax ml liter ⁻¹ | Stimplex Marine extract ml liter ⁻¹ | | | | Nutrient solution mean |
|---|--|------|----------------|------|------------------------|
| | 0 | 4 | 8 | 12 | |
| 0 | 1.12 | 1.78 | 2.44 | 2.51 | 1.96 |
| 2 | 1.33 | 1.80 | 2.65 | 2.69 | 2.12 |
| 4 | 1.54 | 2.12 | 2.54 | 2.78 | 2.24 |
| the marine extract mean | 1.33 | 1.90 | 2.54 | 2.66 | |
| L. S. D. (0.05) | nutrient solution | | marine extract | | inter-actions |
| | 0.206 | | 0.237 | | n.s |

of the nutrient solution Calmax on the phosphorus concentration of date palm leaves resulting from tissue culture of the Lulu variety. The treatment of Calmax nutrient solution at a concentration of 4 ml. liter⁻¹ achieved the highest average of 0.31% compared with the comparison treatment which recorded the lowest average of 0.28% and at the same time it was significantly different from the treatment of the nutrient solution at a concentration of 2 ml.liter⁻¹.

The results in the table showed the effect of Stimplex marine extract and it had a significant effect on phosphorus concentration the treatment with 8 ml liter⁻¹ achieved the highest average of (0.34)% compared to the comparison treatment, which recorded the lowest average of 0.19% and at the same time it differed significantly from the treatment of 4 ml.liter⁻¹ concentration differed significantly from the marine extract treatment at a concentration of 12 ml liter⁻¹. The results showed that the interaction between Calmax and Stimplex marine extract treatment significantly exceeded. The interaction between 4 ml.liter⁻¹ nutrient solution and marine extract at a concentration of 8 ml. liter⁻¹ which achieved the highest average of 0.38% compared to the comparison treatment, which recorded the lowest average of 0.15%.

Potassium content of leaves % 3-percent

The results in Table 4 showed the significant effect of the nutrient solution Calmax on the potassium of the date palm leaves resulting from tissue culture of the Lulu variety. The treatment of Calmax nutrient solution

Table 3: The effect of spraying with the nutrient solution Calmax and Stimplex seaweed extract and the interaction between them on percent phosphorous content of leaves %.

| Nutrient solution Calmax ml liter ⁻¹ | Stimplex Marine extract ml liter ⁻¹ | | | | The Nutrient solution mean |
|---|--|------|-----------------|------|----------------------------|
| | 0 | 4 | 8 | 12 | |
| 0 | 0.15 | 0.29 | 0.37 | 0.30 | 0.28 |
| 2 | 0.20 | 0.26 | 0.26 | 0.31 | 0.26 |
| 4 | 0.23 | 0.29 | 0.38 | 0.36 | 0.31 |
| the marine extract mean | 0.19 | 0.28 | 0.34 | 0.32 | |
| L. S. D. (0.05) | nutrient solution | | Stimplex Marine | | interactions |
| | 0.019 | | 0.022 | | 0.038 |

at a concentration of 4 ml.liter⁻¹ achieved the highest average of 2.80% compared with the comparison treatment which The recorded the lowest average of 2.61% and at the same time, it did not differ significantly from the treatment of marine extract at concentration of 2 ml.liter⁻¹.

The results in the table showed the effect of Stimplex marine extract and it had a significant effect on the potassium concentration of the treatment with 8 ml liter⁻¹ achieved the highest average of 3.11% compared with the comparison treatment, which recorded an average of 2.10% and at the same time it differed significantly from the treatment of a concentration of 4 ml.liter⁻¹ but did not differ significantly from the treatment of marine extract a concentration of 12 ml liter⁻¹. The results showed that the interaction between the treatment of the nutrient solution Calmax and the treatment of the marine extract Stimplex significantly outperformed the treatment of the interaction between the concentrated nutrient solution of 2 ml.liter⁻¹ and marine extract at a concentration of 8 ml.liter⁻¹ that achieved the highest average of 3.28%, compared with the comparison treatment, which recorded the lowest average of 1.75%.

Through Tables 2, 3 and 4 the reason for the increase in the significant component (N and P and K) by increase in the concentrations of Calmax nutrient solution is due to the use of the organic nutrient containing amino acids may cause an increase in the absorption of elements by the plant and thus increase

Table 4: The effect of spraying with nutrient solution Calmax and Stimplex marine algae extract and the interaction between them on percent potassium content of leaves.

| Nutrient solution Calmax ml liter ⁻¹ | Stimplex Marine extract ml liter ⁻¹ | | | | The Nutrient solution mean |
|---|--|------|----------------|------|----------------------------|
| | 0 | 4 | 8 | 12 | |
| 0 | 1.75 | 2.57 | 3.04 | 3.06 | 2.61 |
| 2 | 2.17 | 2.73 | 3.28 | 2.98 | 2.79 |
| 4 | 2.39 | 2.90 | 3.00 | 2.92 | 2.80 |
| the marine extract mean | 2.10 | 2.73 | 3.11 | 2.99 | |
| L. S. D. (0.05) | nutrient solution | | Marine extract | | interactions |
| | 0.16 | | 0.19 | | 0.33 |

the leaves content of elements and this result agrees with Milosevic and Milosevic (2013). The another reason is due to cytokines and gibberellins that work to increase vegetative growth, which leads to pushing the plant to absorb the nutrients in order to replace the nutritional balance, so their concentrations increase in the plant, including nitrogen, phosphorus and potassium.

The reason for the increase is the elements (N, P and K) when spraying with the marine extract Stimplex. Concentrations may be due to the components of the marine extract, the reason for an increase in the element of nitrogen, phosphorous and potassium. These results are consistent with what was found by of Al-Mubarak (2014) in their study of the date palm trees variety Barhi, by spraying with two levels of Kelpak algae extract (8 and 16 cm³L⁻¹). Thus through spraying with this extract led to a significant increase in the leaves content of nitrogen, phosphorous and potassium.

Leaf content of total dissolved carbohydrates

Table 5 showed that the spraying with the nutrient solution Calmax was a significant effect on the total dissolved carbohydrates of the date palm leaves, resulting from tissue cultivation of the Lulu variety. The treatment of Calmax nutrient solution at a concentration of 4 ml.liter⁻¹ achieved the highest average of 13.41 mg gm⁻¹ compared with the comparison treatment which recorded the lowest average of 10.38 mg.gm⁻¹ at the same time, it was significantly different from the treatment of the nutrient solution, the concentration of 2 ml.liter⁻¹.

Table 5: The effect of spraying with nutrient solution Calmax and Stimplex seaweed extract and the interaction between them on percent total dissolved carbohydrates content of leaves (mg gm⁻¹).

| Nutrient solution Calmax ml liter ⁻¹ | Stimplex Marine extract ml liter ⁻¹ | | | | The Nutrient solution mean |
|---|--|-------|----------------|-------|----------------------------|
| | 0 | 4 | 8 | 12 | |
| 0 | 5.45 | 10.66 | 12.61 | 12.81 | 10.38 |
| 2 | 12.5 | 12.90 | 12.66 | 12.98 | 12.77 |
| 4 | 13.18 | 13.39 | 13.50 | 13.56 | 13.41 |
| the marine extract mean | 10.39 | 12.31 | 12.92 | 13.11 | |
| L. S. D. (0.05) | nutrient solution | | Marine extract | | interactions |
| | 0.46 | | 0.53 | | 0.92 |

The reason for this significant increase in carbohydrates may be due to the increase in the nutrient solution Calmax to an increase in the concentration of the total chlorophyll pigment in the leaves and thus causes an increase in the manufacture of carbohydrates. These results are consistent with what Sharif (2011b) obtained in his study on the date palm variety, which found fertilizing with Karma fertilizer on the trees increased the photosynthesis process especially the processed carbohydrates. The results in the **table** showed the effect of spraying with Stimplex marine extract and it had a significant effect on the concentration of total dissolved carbohydrates. At the same time, treatment differed significantly from the treatment of marine extract with a concentration of 8 ml.liter⁻¹ and from a treatment of 4 ml liter⁻¹ and they differed significantly.

The reason for the significant increase in the concentration of carbohydrates in the leaves as a result of treatment with Stimplex seaweed extract may be due to the role of the components of this extract in protecting the molecules of the total chlorophyll pigment in the leaves and preventing them from degradation, as well as the role of these components in building the proteins related to the chlorophyll pigment as well as its enzymes [Basak (2008)]. The results of this study are in agreement with those obtained by Zagzog *et al.* (2017). These results agree with Al-Mubarak (2014), where she noticed that spraying seaweed extract with a concentration of 16 cm³ liters⁻¹ on date palm trees was classified as Barhi, which caused a significant increase in the amount of total dissolved carbohydrates in the leaf, up to 59.86 mg 100 mg gm⁻¹ while the comparison treatment recorded the lowest value, which amounted to 57.44 mg 100 gm⁻¹. The results also showed that the interaction between the nutrient solution Calmax treatment and the Stimplex marine extract treatment significantly exceeded. The interaction between the nutrient solution at a concentration of 4 ml.liter⁻¹ and the marine extract at a concentration of 12 ml.liter⁻¹ achieved the highest average of 13.563 mg.gm⁻¹ compared with the comparison treatment which recorded the lowest mean of 5.450 mg.gm⁻¹.

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References

- Abdulrazzaq, S.N. and S.O. Mohammed (2019). The role of Growth Regulators and Yeast in Vegetative Yield and Some Medicinally Active Compounds of *Aloe vera* L. *International Journal of Agricultural and Statistical Sciences*, **15(1)**, 243-248.
- Al-Mubarak, Noor Raad (2014). Effect of spraying kelpak seaweed extract and NPK neutral fertilizer on some characteristics of date palm leaves, fruits and yield components, *Phoenix dactylifera* L. Barhi variety. *Master thesis*, College of Agriculture, Basra University, Iraq.
- Basak, A. (2008). Effect of preharvest treatment with seaweed products, Kelpak® and Goëmar BM 86®, on fruit quality in apple. *Int. J. Fruit Sci.*, **8**, 1-14.
- Herbert, D., P.J. Phillips and R.E. Strang (1971). *Methods in Microbiology*. In J.R. Norris and D.W. Robbins. (eds) Acad. Press, London and New York.
- Hesse, P.R. (1971). *A textbook of Soil Chemical Analysis*. John Murray. London, Britain.
- Issa, F.H., H.O. Lamloom and H.H. Harby (2019). Effect of liquorice extract, yeast suspension and boron on growth and yield of three cultivars of bean (*Vicia faba* L.). *International Journal of Agricultural and Statistical Sciences*, **15(1)**, 307-310.
- Jackson, M.L. (1958). *Soil Chemical Analysis Prentice*. Hall. Inc. Englewood, cliffs, N.J.
- Milosevic, T. and N. Milosevic (2013). The effect of Zeolite, organic and inorganic fertilizers on soil chemical properties, growth and biomass yield of apple trees. *Plant soil environ.*, **55(12)**, 528-535.
- Omar, M.S., M.K. Hameed and M.S. Al-Rawi (1992). Micropropagation of date palm (*Phoenix dactylafera* L.). In: Bajaj, Y.P.S. ed. *Biotechnology in agriculture and forestry* Vol. 18 High.tech. and micropropagation II. Springer-Verlag, Berlin, Headel. Berg.
- Page, A.L., R.H. Miller and D.R. Kenney (1982). *Methods of Soil Analysis*. Part 2, 2nd. Ed. Agronomy.
- Sherif, Hussain Jassim (2011b). The effect of spraying urea and NPK on leaves on the yield of date palms, *Phoenix dactylifera* L., Khadrawi variety. *Basra Research Journal for Date Palm Research*, **10(1)**, 67-56.
- Thomas, J., A.K. Mandal, R.R. Kumar and A. Chordia (2009). Role of biologically active amino acid formulations on quality and crop productivity of tea *Camellia* Sp. *Int. J. Agri. Res.*, **4(7)**, 228-236.
- Zagzog, O.A., Mohamed M. Gad and N.K. Hafez (2017). Effect of Nano-chitosan on Vegetative Growth, Fruiting and Resistance of Malformation of Mango. *Trends in Horticultural Research*, **7(1)**, 11-18.
- Zamani, S., S. Khorasaninejad and B. Kashefi (2013). The importance role of seaweeds of some characters of plant. *International Journal of Agriculture and Crop Sciences*, **5(16)**, 1789-1793.