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ORIGINAL ARTICLE

EFFECT OF LICORICE AND MARINE ALGAE EXTRACT ON THE GROWTH AND YIELD OF YILDIZ (ICE PLANT)

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Abstract: The plant and algae extracts enhancing the growth and crop yield and quality. Moreover, it is ecofriendly. So a study was carried out for the period from 2019 to 2020 on the winter Ice plant to study the effect of licorice extract and Marine algae extract. A randomized complete block design was used with three concentrations of licorice and four concentrations of Marine algae extract. The averages were tested according to LSD at a probability level of 0.5. The results showed a significant differences in the bilateral interaction between the two factors in the amount of anthocyanin, diameter, number of flowers, leaf area, amount of chlorophyll and number of roots, which amounted to 39.72 mg 100 g^{-1} fresh weight, 10.42 cm, 10.46 cm^2, 262.18 mg.plant.root $^{-1}$ sequentially.

***Key words*:** Foliar application,Licorice extract ,Marine algae,I ce plant.

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1. Introduction

Yildiz (Mesembryanthemum criniflorum) is a winter plant belongs to the Aizoneae family, its original home is Indonesia and Africa, multi-colored flowers, not suitable for commercial picking. Plants have many medicinal uses. The plant is used in the treatment of liver, kidney and dysentery diseases, as well as in the treatment of respiratory and urinary infections [Paliwal (2013)].

Organic agricultural practices are becoming more popular because of consumers' increased interested in their applications demand on safer agricultural products [AL-Obaidy (2019)]. Organic agriculture is the environmentally friendly response to traditional agriculture, which uses chemical pesticides and fertilizers [Manea *et al.* (2019), Slomy *et al.* (2019), Al-Khafajy *et al.* (2020)].

Plant bio-stimulants such as plant and algae extracts generally fall within one of these categories *i.e.* hormone-containing products, micronutrients based products, amino acid-containing products and humic acid-containing products [AL-Taey *et al.* (2017)]. Plant bio-stimulants are used to treat crops in a commercial setting in view of their ability to increase growth rates, increase stress tolerance, increase the photosynthetic rate and increase disease tolerance [AL-Taey *et al.* (2019), Jasman *et al.* (2019)].

Algae spread in different environments around the world, they are found in the aquatic environment or on land. Algae are divided according to the approved bases into eight Phylla phyla, but only three of them are classified as seaweed: the green algae Chlorophyta, the red algae Rhodophyta and the brown algae Phaeophyta, which are used as organic or biological fertilizers. lgareen is marine algae extract that contain low concentrations of auxins, cytokinins, zinc, iron, manganese and magnesium [Al-Bayati *et al.* (2020)], which have a significant role in the development of plant growth and induction of flowering. 250 mg.L^{-1} in flower holder length, plant height, corm weight and yield

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increase for tulip plant. Hamza and AL-Taey (2020) pointed out the role of Cytokinines in transporting mineral nutrients from roots to other parts of the plant, especially phosphate, which positively affects the growth and development of the plant, between effect of benzyladanine at a concentration of 400 mg.L^{-1} on increasing the number of leaves and flowers compared to other treatments.

One of the problems faced by the Yildiz plant is the small number of blooming flowers on the plant and their small size, so the study aimed to increase the size and number of flowers of the Yildiz plant.

2. Materials and Methods

The study was conducted in the Horticulture department of Agriculture college, Anbar university, the experiment. The experiment was designed using a randomized complete block design (RCBD) with three concentrations of the first factor represented by licorice extract, 0, 2.5 and 5 gm.L^{-1}, symbolized by the symbol I0, I1 and I2, as each of the mentioned weights were placed in a liter of the water was heated at a certain temperature that did not reach the boiling point, then filtered and sprayed on the vegetative group by three times. The first spray was a month after planting the seedlings in October. The second is the use of four concentrations of seaweed extract 0, 2, 4 and 6 mg.L^{-1}, symbolized by the symbol T0, T1, T2 and T4.

The plants were sprayed of the vegetative system simultaneously and spraying licorice extract for a period of one week and by three times. The first spray was two weeks after planting the seedlings, the second spray was a month after the first spray and the third spray was a month after the second spray. The results were analyzed using the SPSS program at a probability level of 0.5

Study parameters

Anthocyanin pigment was determined based on Cadot *et al.* (2012).

Flower diameter: Measure the diameter of all flowers for three plants, then the general average of flower diameter was calculated.

Number of flowers: The total number of flowers for three plants was calculated, then the flowers number average was calculated.

Relative content of chlorophyll: Use the Spad device to find out the relative content of chlorophyll in the 5 leaves.

Number of roots: according to the average number of roots for three plants per treatment and

Table 1: Effect of licorice extract and Marine algae extract on the amount of anthocyanin pigment (mg.100gm^{-1} fresh weight) of Yildiz plant.

Licorice extract (I) gm.L^{-1}	algae extract ml^{-1}.L (T)				average (I)
	T_0	T_1	T_2	T_3	
I_0	17.22	20.08	24.52	24.14	21.49
I_1	19.50	26.12	39.72	35.44	30.19
I_2	19.02	22.14	35.50	32.20	27.21
(T average)	18.58	22.78	33.24	30.59	L.S.D.0.051.12 Licorice extract
L. S.D. 0.05 algae extract	1.24				
L. S.D. 0.05 interaction	2.22				1.20

T = algae extract ml^{-1}.L, I = Licorice extract (I) gm.L^{-1}.

Table 2: Effect of Licorice Extract and Algae Extract on Flower Diameter (mm) of Winter Yildiz Plant.

Licorice extract (I) gm.L^{-1}	algae extract ml^{-1}.L (T)				average (I)
	T_0	T_1	T_2	T_3	
I_0	6.02	6.55	7.22	7.03	6.70
I_1	6.92	9.11	10.42	8.02	8.61
I_2	6.85	8.21	8.44	8.11	7.90
(T average)	6.59	7.95	8.69	7.72	L.S.D. 0.05 algae extract
L. S.D. 0.05 algae extract	0.68				
L. S.D. 0.05 interaction	1.22				0.62

T = algae extract ml^{-1}.L, I = Licorice extract (I) gm.L^{-1}.

calculate the average root length.

3. Results and Discussion

Table 1 showed that treatment (I1) at a concentration of 2.5 gm.L-1 of licorice extract achieved the significant value in anthocyanin pigment in petal leaves of Yildiz plant, which was 30.19 mg^{-1} fresh weight and the marine algae extract (T2) at a concentration of 4 $mg.L^{-1}$ significantly outperformed the rest of the treatments reached to 33.24 mg 100 g^{-1} fresh weight, while the amount of anthocyanins decreased when the control treatment T0 reached 18.58 mg 100 g^{-1} fresh weight.

The interaction showed a significant difference between the treatment , the best treatment was I2T2 which recored 39.72 mg.

Average flower diameter (cm): The results of Table 2 confirmed the significant effect of licorice treatment (I1) at a concentration of 2.5 $gm.L^{-1}$, amounted to 8.61 cm. 8.69 cm and the lowest value at comparison treatment was 6.59 cm.

The binary interaction recorded significant effect, the treatment T2I1 achieved the highest reached to 10.42 cm.

Number of flowers: The treatment of licorice extract in Table 3 showed a significant effect in the average of flower number at a concentration of 2.5 $gm.L^{-1}$ (I1) amounted to 9.28 plant $flowers^{-1}$ and for a treatment of licorice extract at a concentration of 4 $g.L^{-1}$, the significant effect amounted to 9.73 flowers $Plant^{-1}$, while the lowest value of flower number in control treatments, as for the interaction between the study factors, the two treatments I1T2 and T22I achieved the highest values, reaching to 10.46 and 9.65 flower $plant^{-1}$.

leaf area (cm^2): Table 4 showed that treatments I1 and I2 were achieved the highest values of the average leaf area which amounted to 9.47 and 8.97 cm^2, respectively and the treatments of seaweed extract T2, T3 and T1 were significantly different, reaching to 9.49, 9.17 and 9.14 cm^2, respectively while the comparison treatment recorded 8.35 cm^2.

The binary interaction between the study treatments recorded significant effects, the treatments I1T2 and I1T3 significantly achieved the best values and they reached 10.14 and 9.50 cm^2, respectively while the lowest value was 8.12 cm^2 at the comparison treatment.

Table 5 showed significant differences in chlorophyll contents in the leaves, the treatment I1 achieved highest value of chlorophyll contents, reaching 259.17 mg 100 gm fresh $weight^{-1}$, While the control treatment recorded the lowest value of chlorophyll content in the leaves.

Table 3: Effect of Licorice Extract and Marine algae extract on the Average Number of Flowers (Flower $Plant^{-1}$) of Yildiz Plant.

Licorice extract (I) $gm.L^{-1}$	algae extract $ml^{-1}.L$ (T)				average (I)
	T_0	T_1	T_2	T_3	
I_0	17.22	20.08	24.52	24.14	21.49
I_1	19.50	26.12	39.72	35.44	30.19
I_2	19.02	22.14	35.50	32.20	27.21
(T average)	18.58	22.78	33.24	30.59	L.S.D. 0.05 algae extract
L. S.D. 0.05 algae extract	1.24				
L. S.D. 0.05 interaction	2.22				1.20

T = algae extract $ml^{-1}.L$, I = Licorice extract (I) $gm.L^{-1}$.

Table 4: Effect of licorice extract and Marine algae extract on leaf area (cm^2) of Yildiz plant.

Licorice extract (I) $gm.L^{-1}$	algae extract $ml^{-1}.L$ (T)				average (I)
	T_0	T_1	T_2	T_3	
I_0	212.02	244.25	230.04	236.22	230.63
I_1	230.14	256.22	310.12	240.21	259.17
I_2	225.05	248.33	262.18	255.34	247.72
T average	222.40	249.60	267.44	243.92	LSD 0.05 licorice extract
LSD 0.05 Extract of algae	7.12				
L. S.D. 0.05 interaction	12.40				6.22

T = algae extract $ml^{-1}.L$, I = Licorice extract (I) $gm.L^{-1}$.

The treatment of licorice I2 extract achieved the highest value of chlorophyll content in leaves amounted to 267.44 mg 100 gm fresh weight^{-1}, while the binary interaction record a significant effects between the values, the I1T2 treatment achieved the highest value of chlorophyll contents amounted to 310.12 mg 100 gm fresh weight^{-1}.

Number of roots (plant root^{-1}): Table 6 showed significant differences of the average number of roots. Treatment I1 recorded the best value in the number of roots reached to 11.12 plant root^{-1}. In contrast, the number of roots decreased when treatment I0 reached 9.59 mg 100 gm fresh weight^{-1} and when the treatment of marine algae extract achieved highest value at T2 treatment, which amounted to 11.44 plant root^{-1}.

The results of Tables 1, 2, 3, 4, 5 and 6 confirmed the presence of significant differences in anthocyanin pigment in flowers, diameter, number of flowers, leaf area, chlorophyll contents and number of roots when foliar spraying with licorice extract at levels 2.5 g and 5 g.L^{-1}. This is because the extract contains the essential nutrients, including the phosphorous, which has a major role in the process of photophosphorylation and its main role in the process of division and elongation and its contribution to the production and transfer of energy to all parts of the plant, in addition to its role in the process of photosynthesis and respiration, or may the licorice extract contains potassium, which plays a key role in the processes of opening and closing stomata and has a role in the activation process of enzymes and its participation in the photosynthesis process.

The licorice extract is characterized by containing glycyrrhizic acid, which begins its formation from the organic acid mevalonic acid, which is the basis for the gibberellins formation and licorice extract plays a key role in increasing the level of internal gibberellins, which leads to stimulating vegetative growths from dormant buds and has a role in converting complex compounds into simpler compounds by influencing the enzymes responsible for the conversion process and the extract contains sugars that are absorbed by the plant and thus obtain the energy needed for all vital processes. As for the increase in vegetative growth resulting from the effect of spraying marine algae extract, it may be due to the content of this extract of major nutrients micro and plant hormones, especially auxins and cytokinins, which have an effective role in increasing growth [Strik *et al.* (2003)]. Also, auxin-like substances are increased in plants treated with seaweed extract [Khan *et al.*

Table 5: Effect of licorice extract and Marine algae extract on the average relative content of chlorophyll (mg 100 g^{-1} fresh wt) of wintering Yildiz plant.

Licorice extract (I) gm.L^{-1}	**algae extract ml^{-1}.L (T)**				**average (I)**
	T_0	**T_1**	**T_2**	**T_3**	
T_0	T_1	T_2	T_3		
I_0	8.12	8.88	9.02	8.92	8.73
I_1	8.62	9.40	10.14	9.50	9.41
I_2	8.32	9.24	9.33	9.00	8.97
T average	8.35	9.17	9.49	9.14	LSD 0.05 licorice extract
LSD 0.05 Extract of algae	0.56				
L. S.D. 0.05 interaction	0.78				0.52

T = Algae extract ml^{-1}.L, I = Licorice extract (I) gm.L^{-1}.

Table 6: Effect of Licorice Extract and Marine algae extract on Root Number of Winter Yildiz Plant.

Licorice extract (I) gm.L^{-1}	**algae extract ml^{-1}.L (T)**				**average (I)**
	T_0	**T_1**	**T_2**	**T_3**	
I_0	9.22	9.82	9.94	9.40	9.59
I_1	9.75	11.13	13.50	10.11	11.12
I_2	9.43	10.22	10.90	9.66	10.05
T average	9.46	10.36	11.44	9.72	LSD 0.05 licorice extract
LSD 0.05 Extract of algae	0.67				
L. S.D. 0.05 interaction	0.74				0.62

T = Algae extract ml^{-1}.L, I = Licorice extract (I) gm.L^{-1}.

(2009)]. The significant effect achieved by algae sea weed application may be attributed to their content of essential nutrients for growth such as nitrogen, phosphorous, potassium, vitamins, amino and organic acids, that have a wide range of influence in the vital activities of the plant [Osman *et al*. (2010)] and therefore increasing its uptake by the plant, which is positively reflected in the increase in the vegetative growth of plants. The reason for the increase in some vegetative characteristics may be due to the algae seaweed containing nutrients that lead to an increase in the metabolic activities of the plant, including potassium, which is necessary in activating enzymes for the formation of protein, as well as helps to manufacture chlorophyll important in the photosynthesis process and the formation of sugars, proteins and energy ATP, which all affect the increase in plant growth and size, which ultimately leads to an increase in vegetative growth characteristics [Martin (2012)].

4. Conclusion

Licorice and Marine algae extract had achieved a significant difference in anthocyanin pigment in flowers, diameter, number of flowers, leaf area, chlorophyll contents and number of roots, this results confirmed the role of plant and seaweed extracts to improve plant growth.

References

Al-Bayati, A.S., H.S. Jaafar and N.J.R. Alhasnawi (2020). Evaluation of Eggplant via different drip irrigation intervals and Foliar sprays with Seaweed extract biostimulant. *Int. J. Agricult. Stat. Sci.,* **16(Supplement 1)**, 2013-2019. DocID: https://connectjournals.com/03899.2020.16.2013

Al-Khafajy, R.A., D.K.A. AL-Taey and M.H.S. AL-Mohammed (2020). The impact of Water Quality, Bio fertilizers and Selenium Spraying on some Vegetative and Flowering Growth Parameters of *Calendula Officinalis* L. under Salinity Stress. *Int. J. Agricult. Stat. Sci*., **16(Supplement 1)**, 1175-1180. https://connectjournals.com/03899.2020.16.1175.

AL-Obaidy, R.M. (2019). Organic Agriculture between the prospects and future challenges-A Review. *Int. J. Agricult. Stat. Sci.,* **15(1)**, 111-113.

Al-Taey, D.K.A., M.J.H. Al-Shareefi, A.K. MijweL, A.Rz. Al-Tawaha and A.Rm. Al-Tawaha (2019). The beneficial effects of bio-fertilizers combinations and humic acid on growth, yield parameters and nitrogen content of broccoli grown under drip irrigation system. *Bulgarian Journal of Agricultural Science,* **25(5)**, 959-966.

AL-Taey, D.K.A., A.S.H. Al-Janabi and A.M. Rachid (2017). Effect of water salinity, Organic and minerals fertilization on growth and some nutrients elements in cabbage *Brassica oleracea* varapitate. *Babylon Journal of Pure and Applied Sciences*, **25(6)**, 2046-2064. https://www.journalofbabylon.com/index.php/JUBPAS/article/view/300/152

Cadot, Y., S. Caillé , A. Samson, G. Barbeau and V. Cheynier (2012). Sensory representation of typicality of Cabernet franc wines related to phenolic composition: impact of ripening stage and maceration time. *Analytica Chimica Acta*, **723**, 91-99.

Hamza, O.M. and D.K.A. AL-Taey. (2020). A study on the effect of glutamic acid and benzyl adenine application upon growth and yield parameters and active components of two Broccoli hybrids. *Int. J. Agricult. Stat. Sci*., **16(Supplement 1)**, 1163-1167. **DocID**: https://connectjournals.com/03899.2020.16.1163

Jasman, A.K., A.K. Slomy, M.R. Sahib, D.K.A. AL-Taey and A. Abd Ali (2019). Evaluation of Mirabilis jalapa and Conocarpus erectus Extracts against *Bemisia tabaci* and Myzus persicae on *Solanum melongena* Plants under Laboratory and Field Conditions. *Biopestic. Int.* **15(1)**, 39-44.

Khan, W., U.P. Rayirath, S. Subramanian, M.N. Jithesh, P. Rayorath, D.M. Hodges, A.T. Critchley, J.S. Craigie, J. Norrie and B. Prithiviraj (2009). Seaweed Extracts as Biostimulants of Plant Growth and Development (Review). *J. of Plant Growth Regul.,* **32(4)**, 66-75.

Manea, A.I., H.J. AL-Bayati and D.K.A. AL-Taey (2019). Impact of yeast extract, zinc sulphate and organic fertilizers spraying on potato growth and yield. *Res. on Crops,* **20(1)**, 95-100. DOI: 10.31830/2348-7542.2019.013

Martin, J. (2012). Impact of Marine extracts applications on cv. *Syrah grape* (*Vitis vinifera* L.) yield components, harvest juice quality parameters and nutrient uptake. *A Thesis*, The Faculty of California Polytechnic State University, *San Luis Obispo,* **50(3)**, 88-101.

Osman, S.M., M.A. Khamis and A.M. Thorya (2010). Effect of mineral and Bio-NPK soil application on vegetative growth, flowering, fruiting and leaf chemical composition of young olive trees. *Res. J. Agric. Biol. Sci.,* **6(1)**, 54-63.

Paliwal, H.K. (2013). Ornamental gardening. *A users companian,* **14(2)**, 18-28.

Slomy A.K., A.K. Jasman, F.J. Kadhim, D.K.A. AL-Taey and M.R. Sahib (2019). Study impact of some biofactors on the eggplant *Solanum Melongena* L. Vegetative characteristics under glass houses conditions. *Int. J. Agricult. Stat. Sci.,* **15(1)**, 371-374.

Stirk, W.A., M.S. Novak and J. Van Staden (2003). Cytokinins in macroalgae. *Plant Growth Regul.,* **41(1)**, 13-24.