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EFFECT OF ALGAE SEAWEED, *URTICA DIOICA* AND ZINC SULFATE ON SOME YIELD QUALITY AND CHEMICAL PARAMETERS OF BROCCOLI (*BRASSICA OLERACEA* VAR. Italica) PLANT

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ABSTRACT

This study was carried out in an unheated plastic house of the vegetable research farm of Protected Cultivation Department in Zakho Technical Institute/Dohuk Polytechnic University on Broccoli (*Brassica oleracea* var. italica) plant on the period from 1st September 2021 to 1st April 2022, to study the effect of three levels of Algae Seaweed concentration (0, 4, and 8 ml L^{-1}), three levels of *Urtica dioica* (0, 4 and 8 ml L^{-1}) and three levels of Zinc Sulfate (0, 5, 10 g L^{-1}). The results showed that increased Algae seaweed concentrations caused significantly increased head length, head diameter, total Chlorophyll, nitrogen% in leaves, phosphorus% in leaves, protein% and carbohydrates % in heads. In the same time the increased *Urtica dioica* concentrations caused significantly increased in most of studied parameter except total chlorophyll and carbohydrates % so as zinc sulfate which increased in most of studied parameter except carbohydrates %. The best interaction which observed among the three factors was (Algae Seaweed 8 mL^{-1}, *Urtica dioica* 8 mL^{-1} and zinc sulfate 10 $gL^{-1)}$ that gave the highest means for the most of the studied parameters compared with control.

KEYWORDS**:** broccoli, Algae Seaweed, *Urtica dioica*, Zinc Sulfate

INTRODUCTION

Broccoli (*Brassica oleracea* var. italica) is an important vegetable crop that belongs to the Brassicaceae family, the optimum season to grow broccoli is winter, when evapotranspiration is low and rainfall is high. Broccoli requires frequent irrigation to preserve plant health and boost yield since it has shallow roots **(Gomes *et al.*, 2000).** Broccoli is usually transplanted as seedlings. Broccoli is growing in popularity these days because of its diverse applications and high nutritional value **(Singh *et al*., 2015).** Due to its high antioxidant and anticarcinogenic content, broccoli has several health benefits. **(Syed and *et al*., 2023),** Broccoli's antibacterial, antioxidant, immunomodulatory, anticancer, hepatoprotective, cardioprotective, and anti-amnesic properties make it a valuable medicinal ingredient **(Pacheco-Cano *et al*., 2017).**

Due to the fact that algae extracts contain nutrients like N, P, K, Ca, Mg, and S in addition to Zn, Fe, Mn, Cu, Mo, and Co, some growth regulators, polyamines, vitamins, cytokinins, auxines, abscisic acid, vitamins, and nutrients, they can be applied topically to improve vegetable growth **(Zhang and Ervin, 2004; Papenfus *et al.*, 2013; Chojnacka and Kim, 2013).** It has been shown that these extracts have a favorable impact on plant development and seed germination at every stage leading up to and including post-harvest **(Ali *et al*., 2020).** Products made from seaweed have been shown to increased root size and density, which increased germination rates and significantly increases seedling vigor **(Rayorath *et al.*, 2008)**.According to **Parađiković *et al*. (2019),** seaweed extracts help enhanced plant development, yields, and tolerance to biotic and abiotic challenges.

The blooming plant *Urtica dioica* is regarded as a weed because of its quick growth and soil-covering ability. It may help over fertilized soils that are high in phosphate and nitrogen **(Upton, 2013).** The chemical elements calcium, silicon, iron, and copper, as well as the vitamins A, B, C, E, and K, and the bioactive substances flavonoids and phenolic acids, are abundant in *urstica dioica*. Improved growth and development may result from the minerals and other elements included in *Urtica dioica* L. extract, which can promote nutritional availability and absorption **(Miller and Brown, 2017).** According to **Godlewska *et al*. (2020)**, novel botanical extracts may be used as biostimulants of plant growth to enhance the nutritional value, growth, and development of plants. Furthermore, according to **Wahba *et al.* (2013)**, amino acids derived from nettles are organic nitrogenous chemicals that serve as building blocks in the process of protein formation.

The synthesis of the amino acid tryptophan, which is composed of auxin IAA, depends on zinc, an important and required nutrient for plant development. Zinc also stimulates oxidative activities in plant cells. According to **cakmak and Kutman (2018)**, zinc is also necessary for the growth and development of cells, tissues, and organisms. Zinc has a direct impact on respiration, photosynthesis, and carbon metabolism. It also promotes the synthesis of tryptophan, a precursor to IAA, and heightens growth and shoot output. Cell division, ion absorption, fruit growth, cell wall production, sugar translocation, carbohydrate transit and metabolism, water relations, hormone, activation, synthesis of auxin and pollen formation, transformation of carbohydrate and chlorophyll and protein are all profoundly impacted by B and Zn (**Ain *et al*., 2016**). According to **Kant *et al*. (2013),** zinc sulfate significantly increased both the production of heads and the number of leaves per plant.

The specific objectives of the study are to investigate the effect of Algae Seaweed, *Urtica dioica* and Zinc Sulfate on the yield quality and chemical parameters of Broccoli plant under the environmental conditions of Zakho Region.

MATERIAL AND METHODS

This Experiment was performed in unheated poly house provided with a drip irrigation system at Vegetable Research Farm of Protected Cultivation Department in Zakho Technical Institute/Dohuk Polytechnic University for a period from 1st September 2021 to 1st April 2022 to study the effect of three concentrations of Algae Seaweed extract (0, 4, and 8 ml L^{-1}), three concentrations of *Urtica dioica* extract (0, 4, and 8 ml L^{-1}) and three levels of Zinc Sulfate (0 ,5, and 10 g L^{-1}). The plastic house land was well ploughed in July for improved aeration of the soil and to disrupt the shelter of pests and pathogens. The plastic house soil was leveled and divided into three terraces and 11 lines of drip irrigation system were distributed on them then the soil was irrigated and the doors were closed for few days for further disinfection. The seedlings were transplanted on 2nd October at a perforated hole. With distance (50 × 60) cm between plant and rows. The Chemical characteristics of the growing soil are pH 7.10, Ec 0.065 $ds.m^{-1}$, K 27.440 %, P 2.140 %, N 1.040, Organic matter 1.685%.

The extract concentration of the Algae Seaweed, *Urtica dioica* and Zinc sulphate levels were sprayed three times at ten days' intervals. The first spray was done on November 15th. In the end of the experiment the following data were records head weight (g), Head diameter (cm), Chlorophyll content (SPAD), nitrogen% in leaves, phosphorus % in leaves, Zinc % in leaves, protein% in head, carbohydrate % in head. The experiment was performed in a Factorial Randomized Complete Block design (RCBD) with 3 × 3 × 3 = 27 treatment with three replicate and 9 plants for each replicate. The data analysis by using SAS program and the means comparison was done by use Duncan's multiple range test at 5% level of confidence. **(SAS, 2013).**

RESULT

1- Head length (cm).

The result in Table (1) displays that increased Algae seaweed concentration from 0 to 8 ml L^{-1} significantly increased the head length of broccoli from (17.58 to 18.27 cm). The highest head length reached to (18.32 cm) when spray with 8 mg l^{-1} of *Urtica dioica* compared with control which gave 17.65 cm. Using Zinc sulfate significantly increased Head length (cm), the maximum value (18.24) %. was noticed at Zinc sulfate 5 g L^{-1} The triple interaction among Algae seaweed, *Urtica dioica*, and Zinc sulfate caused significantly increased in this parameter and the highest length reached to (19.73) cm for the treatment (Algae seaweed 8 ml L^{-1}, *Urtica dioica* 8 ml L^{-1} and Zinc sulfate 10 g L^{-1}) compared with the least length (15.67) cm for the treatment (Algae seaweed 8 ml L^{-1} + *Urtica dioica* 0 ml L^{-1} + Zinc sulfate 0 g L^{-1}).

Table (1):- Effect of Algae Seaweed, Urtica dioica, Zinc Sulfate and their interaction on the Head length (cm) of Broccoli plant.

Algae Seaweed ml L^{-1}	Urtica dioica ml L^{-1}	Zinc Sulfate g L^{-1}			Mean effect of Algae Seaweed	Mean effect of Urtica Dioica
		0	**5**	**10**		
0	**0**	17.83^{b-g}	17.13^{f-h}	16.00^{hi}	17.58^{b}	17.65^{b}
	4	17.67^{b-g}	18.20^{b-f}	17.83^{b-g}		
	8	18.43^{b-f}	18.43^{b-f}	16.67^{g-i}		
4	**0**	17.93^{b-g}	18.63^{a-e}	18.03^{b-f}	18.00^{a}	17.87^{b}
	4	18.03^{b-f}	17.43^{d-g}	17.30^{e-g}		
	8	17.53^{c-g}	18.70^{a-d}	18.37^{b-f}		
8	**0**	15.67^{i}	19.00^{ab}	18.63^{b-f}	18.27^{a}	18.32^{a}
	4	18.23^{b-f}	17.83^{b-g}	18.27^{b-f}		
	8	18.20^{b-f}	18.83^{a-c}	19.73^{a}		
Mean effect of Zinc sulfate		17.73^{b}	18.24^{a}	17.87^{b}		

*Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Rang Test.

2- Head diameter

The result in Table (2) displays that increased Algae seaweed concentrations from 0 to 8 ml L^{-1} significantly increased the head diameter of broccoli from (17.58 to 18.27 cm). The highest head diameter reached to (19.90 cm) when spray with 8 mg l^{-1} of *Urtica dioica* compared with control which gave (19.22 cm). Using Zinc sulfate significantly increased head diameter (cm), the maximum value (19.91 cm) was noticed at Zinc sulfate 10 g L^{-1} . The triple interaction among Algae seaweed, *Urtica dioica,* and Zinc sulfate caused significantly increased in this parameter and the highest head diameter reached to (22.17 cm) for the treatment (Algae seaweed 4 ml L^{-1} , *Urtica dioica* 8 ml L^{-1} and Zinc sulfate 10 g L^{-1}) compared with the least length (17.30 cm) for the treatment (Algae seaweed 0 ml L^{-1} , *Urtica dioica* 0 ml L^{-1} and Zinc sulfate 10 g L^{-1}).

Table (2):- Effect of Algae Seaweed, Urtica dioica, Zinc Sulfate and their interaction on the head diameter (cm) of Broccoli plant.

Algae Seaweed ml L-1	Urtica dioica ml L-1	Zinc Sulfate g L^{-1}			Mean effect of Algae Seaweed	Mean effect of Urtica Dioica
		0	**5**	**10**		
0	**0**	18.67^{f-l}	18.07^{i-l}	17.30^{l}	17.58^{b}	19.22^{b}
	4	19.03^{f-k}	20.63^{b-e}	17.70j-l		
	8	18.13^{h-l}	19.63^{d-g}	19.83^{d-g}		
4	**0**	17.57^{kl}	19.90^{d-g}	20.90^{a-d}	18.00^{a}	19.29^{b}
	4	18.23^{h-l}	19.83^{d-g}	18.53^{g-l}		
	8	18.67^{f-l}	19.17^{e-j}	22.17^{a}		
8	**0**	19.30^{e-i}	19.67^{d-h}	21.63^{ab}	18.27^{a}	19.90^{a}
	4	20.17^{c-f}	19.90d-g	19.53^{d-h}		
	8	20.17^{c-f}	19.80^{d-g}	21.57^{a-c}		
Mean effect of Zinc sulfate		18.88^{b}	19.62^{a}	19.91^{a}		

*Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Rang Test.

3- Total chlorophyll

The result in Table (3) displays that increased Algae seaweed concentrations from 0 to 8 ml L-^{1} significantly increased the total chlorophyll of broccoli from (65.08 to 73.56). The highest total chlorophyll reached (70.08) when spray with 8 mg l^{-1} of *Urtica dioica* . Using Zinc sulfate significantly increased total chlorophyll, the maximum value (71.35) was noticed at zinc sulfate 10 g L^{-1}. The triple interaction among Algae seaweed, Urtica dioica, and Zinc sulfate caused significantly increased in this parameter and the highest total chlorophyll reached to (75.26) for the treatment (Algae seaweed 8 ml L^{-1} , *Urtica dioica* 8 ml L^{-1} and Zinc sulfate 5 g L^{-1}) compared with the least total chlorophyll (61.25) for the treatment (Algae seaweed 0 ml L^{-1} , *Urtica dioica* 4 ml L^{-1} and Zinc sulfate 0 g L^{-1}).

Table (3):- Effect of Algae Seaweed, Urtica dioica, Zinc Sulfate and their interaction on the Chlorophyll content (SPAD) of leaves in Broccoli plant.

Algae Seaweed ml L^{-1}	Urtica dioica ml L^{-1}	Zinc Sulfate g L^{-1}			Mean effect of Algae Seaweed	Mean effect of Urtica Dioica
		0	**5**	**10**		
0	**0**	63.05^{e}	71.77^{ab}	71.50^{ab}	65.08c	70.08^{a}
	4	61.25^{e}	62.28^{e}	64.35^{de}		
	8	63.34^{e}	64.71^{c-e}	63.48^{e}		
4	**0**	69.75^{a-c}	63.47^{e}	74.71^{ab}	71.33b	69.85^{a}
	4	74.39^{ab}	74.08^{ab}	71.81^{ab}		
	8	65.54^{c-e}	74.63^{ab}	73.57^{ab}		
8	**0**	69.33^{b-d}	74.36^{ab}	72.81^{ab}	73.56a	70.04^{a}
	4	72.46^{ab}	72.80^{ab}	75.19^{a}		
	8	75.11^{a}	75.26^{a}	74.74^{ab}		
Mean effect of Zinc sulfate		68.25^{b}	70.37^{a}	71.35 ^{a}		

*Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Rang Test.

4- Nitrogen % in leaves

The result in Table (4) displays that increased Algae seaweed concentrations from 0 to 8 ml L^{-1} had a significant effect of the nitrogen % in leaves of broccoli; it went from (1.88 to 2.21 %). The highest nitrogen reached to (2.21 %) when spray with 8 mg l^{-1} of *Urtica dioica*. Using Zinc sulfate significantly increased nitrogen (%), the maximum value (2.19 %) was noticed at Zinc sulfate 5 g L^{-1}. The triple interaction among Algae seaweed, *Urtica dioica*, and Zinc sulfate caused significantly increased in this parameter and the highest nitrogen % in leaves reached to (2.71) for the treatment (Algae seaweed 8 ml L^{-1} , *Urtica dioica* 0 ml L^{-1} and Zinc sulfate 5 g L^{-1}) compared with the least (1.58 %) for the treatment (Algae seaweed 0 ml L^{-1} , *Urtica dioica* 4 ml L^{-1} and Zinc sulfate 0 g L^{-1}).

Table (4). Effect of Algae Seaweed, Urtica dioica, Zinc Sulfate and their interaction on the nitrogen % of leaves in Broccoli plant.

Algae Seaweed ml L^{-1}	Urtica dioica ml L^{-1}	Zinc Sulfate g L^{-1}			Mean effect of Algae Seaweed	Mean effect of Urtica Dioica
		0	**5**	**10**		
0	**0**	1.71f-h	1.97d-h	1.94d-h	1.88c	1.97b
	4	1.58h	1.60h	1.78f-h		
	8	1.65h	2.26a-e	2.42a-d		
4	**0**	1.84d-h	2.12b-h	1.90d-h	2.03b	1.93b
	4	2.05c-h	2.24a-f	2.00d-h		
	8	2.06c-h	2.22a-g	1.81d-h		
8	**0**	1.68h	2.71a	1.84d-h	2.21a	2.21a

	4	1.60h	1.90d-h	2.62ab		
	8	2.27a-e	2.66a	2.57a-c		
Mean effect of Zinc sulfate		1.83 b	2.19a	2.10a		

*Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Rang Test.

5- Phosphorus % of leaves

The result in Table (5) displays that increased Algae seaweed concentrations from 0 to 8 ml L^{-1} increased significantly the phosphorus of broccoli leaves from (0.55 to 0.60 %). The highest phosphorus reached to (0.61 %) when spray with 8 mg l^{-1} of *Urtica dioica* compared with control which gave 0.53%. Using Zinc sulfate significantly increased phosphorus (%), the maximum value (0.59 %) was noticed at Zinc sulfate 5 g L^{-1}. The triple interaction among Algae seaweed, *Urtica dioica*, and zinc sulfate caused significantly increased in this parameter and the highest phosphorus reached to (0.78 %) for the treatment (Algae seaweed 8 ml L^{-1} , *Urtica dioica* 8 ml L^{-1} and Zinc sulfate 5 g L^{-1}) compared with the least (0.42%) for the treatment (Algae seaweed 4 ml L^{-1} , *Urtica dioica* 0 ml L^{-1} and Zinc sulfate 5 g L^{-1})

Table (5):- Effect of Algae Seaweed, Urtica dioica, Zinc Sulfate and their interaction on the phosphorus % of leaves in Broccoli plant.

Algae Seaweed ml L^{-1}	Urtica dioica ml L^{-1}	Zinc Sulfate g L^{-1}			Mean effect of Algae Seaweed	Mean effect of Urtica Dioica
		0	**5**	**10**		
0	**0**	0.57^{c-h}	0.55^{d-i}	0.61^{b-g}	0.55^{b}	0.53^{c}
	4	0.56^{d-h}	0.63^{b-f}	0.44^{ij}		
	8	0.48^{h-j}	0.68^{a-c}	0.54^{e-i}		
4	**0**	0.47^{h-j}	0.42^{j}	0.56^{d-h}	0.56^{ab}	0.57^{b}
	4	0.55^{d-i}	0.58^{c-h}	0.61^{b-g}		
	8	0.62^{b-f}	0.51^{f-j}	0.69^{ab}		
8	**0**	0.54^{e-i}	0.51^{f-j}	0.55^{d-i}	0.60^{a}	0.61^{a}
	4	0.54^{e-i}	0.65^{b-d}	0.61^{b-g}		
	8	0.53^{f-i}	0.78^{a}	0.65^{b-d}		
Mean effect of Zinc sulfate		0.54^{b}	0.59^{a}	0.58^{a}		

*Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Rang Test.

6- Protein % in heads.

The result in Table (6) displays that increased Algae seaweed concentrations from 0 to 8 ml L^{-1} significantly increased the protein % of broccoli heads from (11.75 to 13.81 %). The highest protein % reached to (13.81 %) when spray with 8 mg l^{-1} of *Urtica dioica*. Using zinc sulfate significantly increased protein (%) in heads, the maximum value (13.68 %) was noticed at zinc sulfate 5 g L^{-1}. The triple interaction among Algae seaweed, *Urtica dioica*, and Zinc sulfate caused significantly increased in this parameter and the highest protein % reached to (16.93 %) for the treatment (Algae seaweed 8 ml L^{-1} , *Urtica dioica* 0 ml L^{-1} and Zinc sulfate 5 g L^{-1}) compared with the least (9.87 %) for the treatment (Algae seaweed 0 ml L^{-1} , *Urtica dioica* 4 ml L^{-1} and Zinc sulfate 0 g L^{-1}).

Table (6):- Effect of Algae Seaweed, Urtica dioica, Zinc Sulfate and their interaction on the protein % of heads in Broccoli plant.

Algae Seaweed ml L^{-1}	Urtica dioica ml L^{-1}	Zinc Sulfate g L^{-1} 0	5	10	Mean effect of Algae Seaweed	Mean effect of Urtica Dioica
0	0	10.68^{f-h}	12.31^{d-h}	12.13^{d-h}	11.75^{c}	12.31^{b}
	4	9.87^{h}	10.00^{h}	11.13^{f-h}		
	8	10.31^{h}	14.13^{a-e}	15.13^{a-d}		
4	0	11.50^{d-h}	13.25^{b-h}	11.87^{d-h}	12.68^{b}	12.06^{b}
	4	12.81^{c-h}	14.00^{a-f}	12.5^{d-h}		
	8	12.88^{c-h}	13.87^{a-g}	11.31^{h}		
8	0	10.50^{h}	16.93^{a}	11.50^{dh}	13.81^{a}	13.81^{a}
	4	10.00^{h}	11.88^{d-h}	16.37^{ab}		
	8	14.18^{a-e}	16.62^{a}	16.06^{a-c}		
Mean effect of Zinc sulfate		11.44^{b}	13.68^{a}	13.13^{b}		

*Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Rang Test.

7- Carbohydrates % in Heads.

The result in Table (7) displays that increased Algae seaweed concentrations from 0 to 8 ml L^{-1} increased significantly the carbohydrates of broccoli head from (5.23 to 5.9 %). There were no significant effects of Zinc sulfate and *Urtica dioica* on carbohydrates % of broccoli heads. The triple interaction among Algae seaweed, *Urtica dioica,* and Zinc sulfate caused significantly increased in this parameter and the highest carbohydrates reached to (6.47 %) for the treatment (Algae seaweed 8 ml L^{-1} , *Urtica dioica* 8 ml L^{-1} and Zinc sulfate 10 g L^{-1}) compared with the least (4.87 %) for the treatment (Algae seaweed 0 ml L^{-1} , *Urtica dioica* 4 ml L^{-1} and Zinc sulfate 0 g L^{-1}).

Table (7):- Effect of Algae Seaweed, Urtica dioica, Zinc Sulfate and their interaction on the Carbohydrates % in head of Broccoli plant.

Algae Seaweed ml L^{-1}	Urtica dioica ml L^{-1}	Zinc Sulfate g L^{-1} 0	5	10	Mean effect of Algae Seaweed	Mean effect of Urtica Dioica
0	0	5.38^{b-e}	5.26^{b-e}	5.13^{c-e}	5.23^{c}	5.45^{a}
	4	4.87^{e}	4.92^{de}	5.49^{a-e}		
	8	5.07^{c-e}	5.07^{c-e}	5.87^{a-e}		
4	0	5.10^{c-e}	5.64^{a-e}	5.46^{a-e}	5.55^{b}	5.52^{a}
	4	5.87^{a-e}	5.48^{a-e}	5.48^{a-e}		
	8	5.41^{b-e}	6.00^{a-c}	5.53^{a-e}		
8	0	5.46^{a-e}	5.62^{a-e}	5.99^{a-c}	5.92^{a}	5.74^{a}
	4	5.55^{a-e}	6.19^{ab}	5.79^{a-e}		
	8	5.95^{a-d}	6.27^{ab}	6.47^{a}		
Mean effect of Zinc sulfate		5.41^{a}	5.61^{a}	5.69^{a}		

*Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Rang Test.

DISCUSSIONS

Seaweed extracts can enhance plant growth, productivity and yield, resistance to disease-causing microorganisms, abiotic stress tolerance, and photosynthetic activity. A number of commercial seaweed extract products are on the market for use in horticulture and agriculture. Numerous studies have also demonstrated this. Because seaweed is high in natural components particularly plant hormones, which activate and promote essential plant processes and has a wealth of macro- and micronutrients, it has a substantial impact on yield **(Jan *et al*., 2014).** When seaweed is sprayed, it increases the percentage of nitrogen, potassium, and carbohydrates. This leads to the stimulation of vegetative growth processes, as well as the division and elongation of cells. Furthermore, the increased availability of nutrients balances the vital processes within the plant tissue **(Wagahatulal, 2009).** Spraying seaweed extract may be the result of its high percentage of macro and micronutrients, which are essential to the plant's vital construction and play a role in triggering the metabolism process of carbon and the production of carbohydrates in the leaves. These nutrients are then transferred and stored in the flower disks, increasing the weight of the disc and, ultimately, the yield of each plant and the overall production **(Nardi *et al*., 2002).**

*Urtica dioic'*s stimulating effects and effectiveness in increasing the plant's absorption of macronutrients N, P, and K as well as other nutrients may be the reason for the plant's increased weight after it was added. These factors also increase the concentration of the nutrient in the leaves and its entry into the plant's metabolic processes, which increases the amount of processed nutrients and their transfer to the broccoli plant's flowering discs. Increased agricultural yield is the result of these all-around benefits. **(Sorensen and Thorup-Kristensen 2011)** evaluated the chemical makeup of numerous green solid manures, including nettle. They came to the conclusion that nettle manure included high concentrations of boron (B) and that plant productivity was more affected by green manures' low C:N ratios than by the total quantity of N applied via solid soil treatments **(Sorensen and Thorup-Kristensen, 2011).** As a consequence, we will observe in the result that *Urtica dioica* raised most research parameters. The inclusion of minerals and other nutrients in *Urtica dioica* L. extract may promote nutrient availability and absorption, resulting to better growth and development **(Miller and Brown, 2019).** Organic farmers may now manage and enhance their crops using an ever-growing array of natural products **(Benfatto *et al.*, 2015).**

According to the results, zinc sulfate significantly affected broccoli growth. A beneficial impact of foliar zinc spraying was also shown in the experiment conducted by **Abd El-All (2014).** According to this author, the rate at which zinc increased led to an increase in broccoli yield. Zinc sulfate can benefit broccoli plant growth and yield, but this depends on the concentration that is applied, when and how it is applied, and the surrounding environmental factors. The formation of healthy leaves and a higher yield are facilitated by zinc sulfate. Zinc is a crucial element needed by plants for several metabolic functions, such as protein synthesis, photosynthesis, and enzyme activation **(Marschner, 2012)**. In order to produce broccoli with a healthy head, it enhanced the chlorophyll in the broccoli plant. According to **(Liang *et al.* 2006),** zinc may be a co-factor of broccoli myrosinase and promote sulforaphane synthesis during the early reaction. And zinc, a mineral component that is crucial for sustaining human health as well as a vital plant element **(Branca and Ferrari 2002)**. According to **Moreno *et al.* (2006),** broccoli is an excellent source of zinc, and the plants are able to readily absorb zinc ions. These findings support the importance of broccoli for human health.According to **(AL-Bayati 2019)**, zinc sulfate supplementation resulted in an increase in plant height, stem diameter, and leaf area, suggesting improved vegetative development.

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تأثير مستخلص الطحالب البحرية ومستخلص نبات القريص (.Urtica dioica L) وكبريتات الزنك (ZnSO4) على صفات النمو الخضري والصفات الكيميائية لنبات البروكلي .(Brassica oleracea var. italica)

الخلاصة

أجريت هذه التجربة في البيت البلاستيكي الغير مدفأ لمزرعة الخظراوات التابعة لقسم الزراعة المحمية في معهد زاخو التقني / جامعة دهوك التقنية على نبات البروكلي (Brassica oleracea var. italica) خلال موسم النمو (2021-2022) من الاول من ايلول حتى الأول من نيسان لدراسة تأثير ثلاثة تراكيز من مستخلص الطحالب البحرية (0 ، 4 ، 8 مل /لتر) ، ثلاثة تراكيز من مستخلص نبات القريص (0 ، 4 ، 8 مل/ لتر) وثلاثة مستويات من كبريتات الزنك. (0 ، 5 ، 10 غم/لتر). وقد أظهرت النتائج أن زيادة تركيز الطحالب البحرية تسبب في زيادة معنوية في طول القرص (سم) و قطر القرص (سم) و الكلوروفيل الكلي و النسبة المئوية للنايتروجين والفسفور في الاوراق و النسبة المئوية للبروتين والكاربوهيدرات في القرص وفي نفس الوقت تسبب زيادة تركيز مستخلص نبات القريص في زيادة معنوية في معظم الصفات المدروسة ماعدا الكلوروفيل الكلي والنسبة المئوية للكاربوهيدرات وكذلك زادت كبريتات الزنك في معظم الصفات المدروسة ماعدا النسبة المئوية الكاربوهيدرات وان أفضل تداخل لوحظ بين العوامل الثلاثة (مستخلص الطحالب البحرية 8 مل/لتر، مستخلص نبات القريص 8 مل/لتر وكبريتات الزنك 10 غم/لتر) التي أعطت أعلى فرق معنوي لمعظم الصفات المدروسة مقارنة مع المعاملات الغير مسمدة (control).

کارتیکرنا گیراوه یێ ئالگایا ده ریایی و گیراوێ رووه کێ گه زینك (*Urtica dioica* L.) و زینك سولفاتی (ZnSO4)لسه ر سیفاتێن که سکاتیێ و سیفاتێن کێمایی یێن رووه کێ بروکولی (Brassica oleracea var. italica).

پوخته

ئه ف فه کولینه هاته بجهئینان ل خانێن پلاستیکی یێت به شێ چاندنا پاراستی ل په یمانگه ها ته کنیکی زاخو /زانکویا پولیته کنیك دهوک، لسه ر رووه کێ بروکولی ل سالا (2021-2022) ل ده سپێکا مه ها ئه یلولی تاکو ده سپێکا هه یفا نیسانێ ژبو تاقیکرنا کاتێکرنا سێ تیراتییێن گیراوێ ئالگا ده ریایی (0 ، 4 ، 8 مل /لتر), سێ تیراتییێن گیراوێ رووه کێ گه زینک (0 ، 4 ، 8 مل /لتر) و سێ رێژێن زینک سولفاتی. (0 ، 5 ، 10 گم/لتر) د ده رئه نجامان دا دیار بو رێژا زیده یا ب کارئینانا گیراوێ ئالگایا ده ریایی بو ئه گه رێ زێده بونه کا ئه رێنی د دریژاهیا سه رکی دا(سم) و تیرێ سه رکی (سم) و کرولوفیل ب شێوه کێ گشتی و رێژا سه دی یا نایتروجینی و فسفوری د به لگاندا و رێژا سه دی یا پروتین و کاربوهایدراتی د سه رکی دا، دهه مان ده م دا رێژا زیده یا بکارئینانا گیراوێ رووه کێ گه زینک بو ئه گه رێ زێده‌بونه کا ئه رینی د پرانیا سیفه تێن تاقیکری دا ژبلی کلوروفیلی و رێژا سه دی یا کاربوهیدراتی .هه روه سا بکارئینانا زینک سولفاتی بو ئه‌گه‌رێ زێده بونا بارا پتر یا سیفه‌تان ژبلی رێژا سه دی یا کاربوهیدراتی .باشترین لێکدان دنافبه‌را هه ر سێ سه‌ره‌ده‌ریا (گیراوێ ئالگایا ده ریایی8 مل/لتر ,گیراوێ رووه کێ گه زینک, 8 مل/لتر, زینک سولفات 10 گم/لتر) بو کو باشترین ده رئه نجام دا بو باراپتریا سیفه تێن تاقیکرنێ ب به راوردی دگه‌ل کونترولی.