Influenced of Seaweed Extracts and Its Magnetization in Growth and Yield of Broccoli

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ABSTRACT

The experiment was carried out in private field in north of Babylon province at growth winter season 2017-2018, to evaluate the performance of magnetic seaweed extracts and its foliar application in the growth and yield of Broccoli (*Brassica oleracea* var. *italica* L.) cultivar Paraiso. The experiment was comprised of the seaweed extract concentrations of S0: 0; S1: 2 mL·L^{-1} alga 600; S2: 4 mL·L^{-1} alga 600; S3: 2 mL·L^{-1} alga Al-zuhoor and S4: 4 mL·L^{-1} alga Al-zuhoor combined with the magnetic seaweed extract: control included MF0: without magnetic; MF1:750 guess magnetic field, or MF2: 1500 guess magnetic field. The experiment was arranged in a split-plot system within a Randomized Complete Block Design (RCBD) with magnetics extract as the main plots and seaweed extracts treatment as the sub-plot with 3 replications. The result showed the interaction between 1500 guess magnetic field and 2 mL·L^{-1} alga Al- zuhoor achieved significated plant height 77.67 cm, number of leaves 28.33 leaf plant^{-1}, secondary heads 9.67 head. plant^{-1} and head diameter 25.33 cm, also the treatment of MF2 with S1 arrived to 25.33 cm. The interaction of 4 mL·L^{-1} alga 600 and without magnetic achieved head weight 1452 gm and total yield 34.07 ton.ha^{-1}. The interaction of 4 mL·L^{-1} alga Al- zuhoor and 1500 guess magnetic field achieved greater leaves area 8246 cm^2 and heaviest secondary head 322.07 gm. The best response in plant growth, increased the head yield, with 2 mL·L^{-1} alga Al- zuhoor extract and without magnetic field.

Keyword: *Brassica oleracea* var. Italica, seaweed extracts, Magnetic, vegetable production.

تأثير الرش بمستخلصات الاعشاب البحرية ومغنطتها في نمو وحاصل البروكلي

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الخلاصة:

نفذت الدراسة في شمال محافظة بابل للموسم الزراعي الشتوي 2017-2018، لتقيم اداء الرش بمستخلصات الطحالب البحرية ومغنطة المستخلصات في نمو وحاصل البروكلي (*Brassica oleracea* var. *italica*) صنف Paraiso. تضمنت التجربة تراكيز من مستخلصات البحرية هي (S0: 0، S1: 2 مل.لتر-1 الجا600، S2: 4 مل.لتر$^{-1}$ الجا 600، S3: 2 مل.لتر$^{-1}$ الجا الزهور، S4: 4 مل.لتر$^{-1}$ الجا الزهور بالتداخل مع مغنطة هذه المستخلصات البحرية للفيض المغناطيسي (MF: 0، MF1: 750 كاوس، MF2: 1500 كاوس). نظمت التجربة في نظام القطع المنشقة وفق تصميم القطاعات العشوائية الكاملة اذ وضعت المغنطة في القطع الرئيسية والرش بمستخلصات الطحالب البحرية في القطع الثانوية. اظهرت النتائج ان التداخل بين 1500 كاوس للـ 2 مل.لتر$^{-1}$ الجا الزهور حققت زيادة معنوية في ارتفاع النبات اعلى ارتفاع نبات 77.76 سم، وعدد اوراق والرؤوس الثانوية 28.33 ورقة و 9.67 راس لكل نبات وقطر راس 25.33 سم وكذلك معاملة 1500 كاوس و2 مل.لتر$^{-1}$ الجا 600 حققت نفس قطر الراس 25.33. حقق التداخل بين 4 مل. لتر$^{-1}$ الجا 600 مع عدم المغنطة اكبر وزن للقرص الزهري وحاصل كلي 1452غم و 34.07 طن.هكتار$^{-1}$. حقق التداخل بين 4 مل. لتر$^{-1}$ الجا الزهور اعلى مساحة ورقية للنبات 8246سم^2 واعلى وزن للرؤوس الثانوية 322.7 غم.

الكلمات المفتاحية: البروكلي، مستخلصات الاعشاب البحرية، المغنطة، انتاج خضر.

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Introduction

Sprouting broccoli (***Brassica oleracea*** var. Italica) popularly known as broccoli is an important vegetable crop and a new introduction in Iraq, It contains 3.3% protein and a high content of vitamin A, C, iron and calcium [16], thiamine, niacin, riboflavin and high concentrations of carotenoids [12]. The improvement of vegetative growth in vegetable crops can be carried out in many horticultural services, the most important of which is the fertilization of nutrients, foliar application fertilizer is an efficient method of fertilization. At present experiment, seaweed extracts was used as organic fertilizer for spraying on the leaves through their effectiveness on many vegetable crops [16]; these extracts are contained essential elements for the plant growth such as nitrogen, phosphorus, potassium, iron, copper, zinc and boron [1]. Significant fresh and dry weight increases have been reported when fertilization with kelpak seaweed extract. Seaweed extract "Algamix" increased total yield in lettuce [4]. Foliar application of seaweed extract interaction with Gibberellins which increased plant head, number of leaves, stem diameter, weight plant and marketable yield cauliflower [10]. Foliar application of organic nutrient vegeamino increased percentage of total carbohydrates and protein [7]. Seaweed extract "Biozyme TF" caused increases plant height, leaves area, weight plant, head diameter and total yield in cabbage [3]. Addition of licorice extract + Acadian seaweed extract increased yield of Broccoli [9]. The technology of magnetic water has been developed and subsequently used widely in the field of agriculture in many countries such as Australia, USA, China and Japan. Magnetic field (MF) can stimulate plant growth or prevent it, from other hand MF affected various characteristics of plants like germination of seeds, seedlings growth and reproduction including the growth of meristematic cells and chlorophyll development [13]. Consequently, the magnetic field can be used as an alternative to the chemical methods of plant treatment for improving the production efficiency [5]. The aim research to evaluate the performance of spraying seaweed extracts and magnetic seaweed extracts in the growth and yield of Broccoli.

Materials and Methods

The field experiment was conducted at the private field in Babylon government during winter season 2017-2018; Prior to the start of the experiment random soil samples were taken from 0-30 cm soil depth and analyzed at the Department of Horticulture, Faculty of Agriculture, Al Qasim Green university, to determine physical and chemical properties of the soil (Table 1). The treatment consisted of 15 interactions. The first factor seaweed extract (S0: 0, S1: 2 $gm.L^{-1}$, alga 600, S2: 4 $gm.L^{-1}$ alga 600, S3: 2 $gm.L^{-1}$ alga Al-zuhoor and S4: 4 $gm.L^{-1}$ alaga Al-zuhoor, table 2) and the second factor magnetic sea weed extracts (MF0: without magnetics, MF1: magnetics 750 gauss and MF2: 1500 gauss). The experiment was arranged in a split-plot within a Randomized Complete Block Design (RCBD) with magnetics extract as the main plots and seaweed extracts treatment as the sub-plot with 3 replications. Seedlings were developed by placing seed of the cv. Paraiso (Takii seed, Austral) in seedling trays containing peat moss in 22 Aug. 2016. Tray dimensions were 68×40 cm containing 209 cells. The seedlings were fertilized twice with 1 $g \cdot L^{-1}$ of liquid poultry litter extract (4N-1P-5K%) for all treatment. Trays were placed in a greenhouse and supplied with 2 $L.\ day^{-1}$ of water. Additional irrigation occurred weekly with 3 litter of water per seedling tray. The sandy loam soil was prepared by disking once (3* 0.75 m) the area unit.

Data were recorded on the following parameters from the sample plants during the course of experiment. eight plants were randomly selected from each unit plot to determent plant height, number of leaves, leaves area, head weight, head diameter, number of

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secondary heads, weight of secondry head and total head. The plants in the outer rows and the extreme end of the middle rows were excluded from the random selection to avoid the border effect. The data obtained for different parameters were statistically analyzed to find out the significance difference of seaweed extract and magnetics extracts on growth and yield of broccoli. The data were analyzed by Genstat (2012) and the means were compared according Least Significance Difference (L.S.D) with level 0.05 [6].

Table 1 Chemical and physical properties of the soil of the experimental site.

Parameter	Value unit	Value
pH	-	7.7
Electrical conductivity	$ds \cdot m^{-1}$	2.7
Organic matter	%	1.5
Total N	$mg \cdot kg^{-1}$	85
Available P	$mg \cdot kg^{-1}$	5.0
Exchangeable K	$mg \cdot kg^{-1}$	98
Clay	%	22
Sand	%	54
Silt	%	24
Texture class		silt loam

Table 2. Characteristics of seaweed extracts.

Parameter	Alga 600	Alga Al- zuhoor
N %	0.5-1	4
P2O2 %	6-9	4
K2O %	21-24	4
Ca %	0.4-1.6	2.93
Mg %	0.062	0.032
S %	1-1.5	-
Fe ppm	1500	31
Zn ppm	-	17.5
Mn ppm	-	31
Cu ppm	-	12.6
Organic matter%	40-50	-
Alganic acid %	6-9	-
Amino acid %	4	-
pH	9-11	-
PGRs ppm	600	500

Result and Discussion

The result showed in table (3) that the treatment MF2 containing 1500 gauss performed better for all the growth parameters, as recorded maximum plant height (74.47cm), number of leaves (25.93), leaves area (7681 cm^2) and head diameter (24.60 cm). Compare with control treatment recorded lower plant height (68.33 cm), lowest of leaves (23.67), leaves area (6916 cm^2) and head diameter (21.73 cm). The stimulatory effect of magnetic may be attributed to their role in increasing absorption and assimilation of nutrients consequently increasing plant growth and may be also attributed to the increase in photosynthetic pigment, endogenous promoters (IAA) and increase in protein biosynthesis [14].

The observation recorded on seaweed extracts revealed that the treatment S3 containing recorded maximum plant height (73.56), number of leaves (25.33), leaves area (7513 cm2) and head diameter (24.11 cm), In contrast, control treatment recorded lower plant height (65.67 cm), number of

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leaves (23.11), leaves area (6770 cm^2) and head diameter (21.44 cm). The reason for the superiority of the seaweed extract for plant height, head diameter, number of leaves, leaves area was likely due to it the extract of auxins, cytokanins and many nutrients that stimulate the division of cells and their extension, and their role in the balance of biological processes within the plant tissues [15]. These results are consistent with both [11] and [2].

The results of the table (3) indicate that vegetative growth parameters significantly influenced by the interaction between magnetization and seaweeds extract and the treatment MF2S3 significated in achieved highest plant, leaves area and head diameters, while treatment MF2S2 archived highest number of leaves. The lowest plant height, number of leaves, leaves area and head diameter was obtained from control treatment MF0S0.

Table 3 Effect of magnetic field, seaweed extract and their interaction on vegetative growth parameters of broccoli**.**

Treatments	Plant length (cm)	Number of leaves per plant	Leaves Area (cm^2)	Head diameters (cm)
Magnetic Field				
MF0	68.33	23.67	6916	21.73
MF1	70.93	24.87	7251	23.80
MF2	74.47	25.93	7681	24.60
L.S.D0.05	0.938	2.18	214	1.40
Seaweed Extracts				
S0	65.67	23.11	6770	21.44
S1	71.67	25.22	7169	23.78
S2	73.22	25.33	7465	24.00
S3	73.56	25.33	7513	24.11
S4	72.11	25.11	7496	23.56
L.S.D.0.05	2.642	1.89	320	1.62
Interaction MF * S				
S0	62.00	23.33	6242	18.33
S1	69.00	23.67	7082	22.33
MF0 S2	70.67	23.00	7003	23.67
S3	70.00	24.00	7065	22.00
S4	70.00	24.33	7189	22.33
S0	66.33	23.00	7072	23.00
S1	71.67	26.33	7307	23.67
MF1 S2	72.00	24.67	7308	25.00
S3	73.00	25.67	7515	23.67
S4	71.67	24.67	7053	23.67
S0	68.67	23.00	6995	23.00
S1	74.33	25.67	7118	25.33
MF2 S2	77.00	26.33	8084	24.67
S3	77.67	28.33	7960	25.33
S4	74.67	26.33	8246	24.67
L.S.D 0.05	4.14	3.33	518	2.70

The yield characters were significantly influenced by magnetization, the results (table 4) indicated that the treatment MF2 given highest number and weight of secondary heads 9.27 head. $Plant^{-1}$ and 287.7 gm respectively. In contrast the treatment MF0 which gave the lowest yield, while M0 treatment achieved greater head weight (1146 gm). The treatment MF2 recorder lowest head weight. There

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was no significant effect of magnetization on the total yield.

The results further revealed among treatments seaweed extracts significantly influenced the yield, S1 treatment gave significated head weight and total yield (1239 gm and 20.07 ton. hacter^{-1}. respectively). The height number and weight of secondary heads per plant achieved in treatment S2 and S4 which gave 8.78 head per plant and 291.7gm respectively.

This is due to the role of seaweed extracts in improving the vegetative growth (table 3) and thus increasing photosynthesis and their transfer to the areas of effective growth and accumulation, which encouraged the increase of the head weight and diameter on due to its containing of nutrients and plant growth regulators which role in the balance of plant physiological processes [9]. These results are consistent with both [8] and [2].

The interaction treatment of magnetization and seaweed extracts had a significant increases in yield characters. The weight head and total yield achieved with MF0S2 which were 1452 gm and 34.07 ton.ha^{-1}, MF2S4 gave the number of secondary heads and weight of secondary head which were 9.67 head per plant and 322.7 gm. In contrast the MF0S0 recorder lowest yield characters.

Table 4 Effect of magnetic field, seaweed extracts and their interaction on yield attributes broccoli.

Treatments	Head weight (gm)	Number secondary heads per plant	Weight secondary head (gm)	Total Yield (ton.ha^{-1})
Magnetic Field				
MF0	1146	7.20	228.2	26.89
MF1	1110	8.13	269.3	25.45
MF2	1006	9.27	287.7	23.60
L.S.D0.05	124	0.667	43.15	NS
Seaweed Extracts				
S0	761	7.33	202.9	16.89
S1	1239	8.11	257.2	29.07
S2	1233	8.78	278.0	28.93
S3	1158	8.33	278.8	27.18
S4	1045	8.44	291.7	24.51
L.S.D.0.05	160	0.885	26.71	3.58
Interaction MF * S				
S0	636	6.00	174.7	14.94
S1	1336	6.67	231.0	31.34
MF0 S2	1452	8.33	250.0	34.07
S3	1241	7.33	236.0	29.12
S4	1064	7.67	249.3	24.98
S0	750	7.67	214.7	14.65
S1	1336	8.69	276.3	31.35
MF1 S2	1201	8.33	265.3	28.18
S3	1195	8.00	287.0	28.04
S4	1068	8.00	303.0	25.05
S0	898	8.33	219.3	21.07
S1	1044	9.00	264.3	24.51
MF2 S2	1045	9.66	318.7	24.53
S3	1039	9.67	313.3	24.38
S4	1002	9.66	322.7	23.51
L.S.D 0.05	263	1.448	53.01	6.05

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