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THE ROLE OF ADDING HUMIC ACID AND SEAWEED EXTRACTS BY SPRAYING ON SOME SOIL CHARACTERISTICS AND THE GROWTH AND YIELD OF BARLEY

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Abstract
The experiment was conducted in the winter of 2024-2025 on farmland under the Ministry of Agricultural Guidance and Training (Al-Saddah, Al-Mahnawiyah). The aim was to investigate the effects of three concentrations (0, 100, and 150 mg/L-1) of humic acid spray on plants, as well as three concentrations (0, 1, and 2) of seaweed spray on plants. A randomized completely block design (RCBD) was used, and means were compared using the least significant difference (LSD) test at a 5% significance level. The results showed that after spraying humic acid, some physical and chemical properties of the soil, such as apparent density, water content, soil electrical conductivity EC, soil reactivity pH, and some indicators of plant nutritional growth, such as plant height and number of ears, were significantly improved. The humic acid spraying treatment (2 L/dun am) achieved the highest mean values for the above soil properties and crop growth indicators. The interaction treatment (humic acid spraying treatment (2 L/dun am) and seaweed extract 150 mg/L) also achieved the highest mean values.

Keywords: Humic acid, seaweed extracts, barley.

Introduction

Barley is one of the important crops grown in many countries around the world. Its main use is to produce grains for making various baked goods and in the industrial sector. Barley is one of the important feed crops for silage production (Al-Sanawi et al., 2021). The trend in today's world is to reduce the use of chemical fertilizers, as they are harmful to the environment and health, and use natural alternatives such as seaweed extract, which is extracted from marine plants and has the same natural properties as the substances contained in these plants. They are extracted in a special way and used as organic fertilizers to promote plant growth. They are added directly to the soil or applied to plants by spraying as a supplement to fertilizers, not as a replacement for them. Adding humic acid also promotes plant growth, improves nutrient absorption, and enhances crop growth. Many studies have shown that this approach reduces the amount of fertilizer applied to the soil,

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thereby reducing fertilizer pollution and costs (Al-Rawi et al., 2015). Studies have also found that adding seaweed extracts has a positive impact on the growth rate and yield of the crops studied. This is because they contain a variety of active compounds such as hormones, amino acids, and vitamins, which can help increase agricultural yields (Sarheed, 2012). Spraying plants with humic acid is one of the methods used in the agricultural sector as it has a positive effect on nutrient uptake by plants, as it increases nutrient availability, leading to rapid nutrient uptake by plants (Lutzow et al. 2006). As explained by (Abdul-Jabbar et al., 2012), the addition of seaweed extracts resulted in an increase in vegetative growth indicators such as plant height and flag leaf area and also aided in most of the important physiological functions of various crops.

Objective of the study:

The aim was to understand the extent to which simultaneous spraying of humic acid and seaweed extracts affected certain physical and chemical properties of the soil and the growth and yield of local barley.

Materials and working methods

The field trial was conducted in the autumn of 2024-2025 on agricultural land under the Department of Agricultural Guidance and Training in Al-Saddah, Al-Mahnawiyah to study the effects of spraying humic acid and seaweed extract on barley growth and yield Samples of the study soil were collected before planting in order to analyse them according to the methods mentioned in Black 1965 and Page 1982 as shown in Table (1) which shows some physical and chemical properties of the soil. Field preparation and preparation involved plowing and dividing the field into 3 x 3-meter squares, repeated three times. Diammonium phosphate (DAP) fertilizer was applied in two batches at a rate of 40 kg/ha, and urea fertilizer at a rate of 100 kg/ha. Crops were broadcast sown on November 18, 2024. The fields are irrigated using flood irrigation with an electric pump. Watering is done immediately after planting and again after two weeks if there is sufficient rainfall. Harvesting took place on April 21, 2025, and necessary soil and plant parameters and analyses were performed after harvest. Field measurements were averaged from five plants per experimental unit. Results were statistically analyzed using analysis of variance (ANOVA), and mean values were compared by calculating the least significant difference (LSD) at a significance level of 0.05. Statistical analysis was performed using Excel (Al-Rawi and Khalaf Allah, 2000).

Experiment parameters included

1- Comparison transaction (without addition).
2- Spraying with humic acid (0, 100, 150) mg/L-1.
3- Spraying with seaweed extracts (0, 1, 2) liters. per 1 durum.

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Table (1) Some physical and chemical properties of the study soil before planting.

Traits	Units
Sand	290 g.kg-1
Alluvial	420 g.kg-1
Clay	288 g.kg-1
Soil texture	Loam
Ec electcil conductivity	2.60 dSm.m-1
Ph	7.22
Bulk density	1.37 g/cm3
Moisture content	14 %
Water conductivity	4,6 cm per hour-1

Results and discussion

1- Bulk density (mica g m-1)

We noticed in Table (2) that there were significant differences in the values of soil apparent density, as the control treatment achieved the highest mean value of (1.46), while the treatment (2 liters of humic acid sprayed per dunam-1) achieved the lowest mean value of (1.36). The results in the same table also showed that the control treatment had the highest mean value of (1.45), while the treatment sprayed with 150 mg.L-1 of seaweed extract had the lowest mean value of (1.37). Regarding the interaction, the table shows that there were significant differences in the soil electrical conductivity values, since the control treatment gave the highest value (1.50), while the treatment (spraying plants with humic acid 2 L dunum-1 and seaweed extract 150 mg L-1) gave the lowest value, reaching (1.33).

Table (2) The effect of spraying humic acid, seaweed extracts and their interaction on the bulk density of the soil (mica g m-1).

Bulk density (mica g m-1)				Seaweed extracts mg/L-1
Humic acid liter/acre-1				
Average	2	1	0	
1,45	1,42	1,45	1,50	0
1,39	1,35	1,37	1,45	100
1,37	1,33	1,36	1,44	150
	1,36	1,39	1,46	Average
0,90 Interference		0,53 algae extracts	0,53 Humic	L.S.D

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2_ Soil moisture (%)

From the results in Table (3), we noticed that there was a significant difference in the soil moisture values, as the control treatment achieved the lowest mean value of (12.43), while the treatment (spraying humic acid 2 L·dunum-1) achieved the highest mean value of (15.60). The results of the same table also showed that the control treatment had the lowest mean value of (13.41), while the treatment sprayed with 150 mg.L-1 of seaweed extract had the highest mean value of (14.88). Regarding the interaction, the table shows that there are significant differences in the moisture values, since the control treatment gave the lowest value (12.11), while the treatment (spraying the plants with 2 L of humic acid and 150 mg/L of seaweed extract) gave the highest value, reaching (16.82).

Table (3) The effect of spraying humic acid and seaweed extracts and their interaction on soil moisture %.

Soil moisture%				Seaweed extracts mg/L-1
Humic acid liter/acre-1				
Average	2	1	0	
13,41	14,68	13,45	12,11	0
13,95	15,30	14,27	12,30	100
14,88	16,82	14,92	12,90	150
	15,60	14,21	12,43	Average
1,55 Interactions		0,744 Algae extracts	0,743 Humic	L.S.D

3-Electrical conductivity EC (dS.m-1)

The results in Table (4) show that there were significant differences in soil electrical conductivity values, with the control treatment giving the highest average value of (2.52 dS.m-1) and the treatment sprayed with humic acid 2 L/dunam-1 giving the lowest average value of (2.30 dS.m-1). The results in the same table also show that the control treatment had the highest average value of (2.49 dS-1), while the treatment sprayed with 150 mg.L-1 of seaweed extract had the lowest average value of (2.33 dS-1). Regarding the interaction, the table shows that there were significant differences in the soil electrical conductivity values, since the control treatment gave the highest value (2.60 dS-1), while the treatment (spraying the plants with 2 liters of dunum-1 humic acid and 150 mg. L-1 seaweed extract) gave the lowest value of 2.20 dS-1

Table (4) Effects of spraying humic acid and seaweed extracts and their interactions on soil salinity, Dessiemens 1.m.

Soil salinity decisiemens m-1				Seaweed extracts mg/L-1
Humic acid liter/acre-1				
Average	2	1	0	
2,49	2,41	2,47	2,60	0
2,40	2,31	2,38	2,51	100
2,33	2,20	2,34	2,45	150
	2,30	2,39	2,52	Average
0,88 Interference		0,47 algae extracts	0,47 Humic	L.S.D

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4-Soil reaction degree (PH)

From the results in Table (5), we noticed that there were significant differences in the values of soil reaction degree, as the control treatment achieved the highest mean value of (7.51), while the treatment (spraying humic acid 2 L·dunum-1) had the lowest mean value of (7.35). The results of the same table also showed that the control treatment had the highest mean value of (7.51), while the treatment sprayed with 150 mg.L-1 of seaweed extract had the lowest mean value of (7.351). Regarding the interaction, the table shows that there are significant differences in the values of the degree of soil reaction, since the control treatment gave the highest value (7.58), while the treatment (spraying plants with humic acid 2 L dunum-1 and seaweed extract 150 mg L-1) gave the lowest value, reaching (7.25)

Table (5) Effects of spraying humic acid and seaweed extract and their interaction on the degree of soil reaction.

Degree of soil interaction				Seaweed extracts mg/L-1
Humic acid liter/acre-1				
Average	2	1	0	
7,51	7,47	7,50	7,58	0
7,44	7,35	7,47	7,51	100
7,35	7,25	7,37	7,45	150
	7,35	7,44	7,51	Average
1,18 Interference		0,69 algae extracts	0,69 Humic	L.S.D

5-Area of flag paper (cm2)

In Table (6), we noticed that there were significant differences in the values of flag leaf area of the plants, as the control treatment had the lowest mean value of (16.77), while the treatment sprayed with 2 liters of Dunam-1 humic acid reached the highest mean value of (21.50 square centimeters). The results of the same table also showed that the control treatment had the lowest mean value of (17.64 square centimeters), while the treatment sprayed with 150 mg/L of seaweed extract reached the highest mean value of (21.13 square centimeters). Regarding the interaction, the table shows that there were significant differences in the values of flag leaf area of the plants, since the control treatment gave the lowest value (16.49 cm2), while the treatment (spraying the plants with 2 L of humic acid/dunan-1 and 150 mg/L-1 of seaweed extract) gave the highest value, reaching (24.85 cm2)

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Table (6) Effect of spraying humic acid and seaweed extracts and their interaction on the area of the flag leaf (cm2)

Area of flag paper (cm2)				Seaweed extracts mg/L-1
Humic acid liter/acre-1				
Average	2	1	0	
17,64	18,68	17,77	16,49	0
18,71	20,99	18,58	16,56	100
21,13	24,85	21,27	17,27	150
	21,50	19,20	16,77	Average
2 ,1 Interference		1,62algae extracts	1,62 Humic	L.S.D

6-Number of spikes (m2)

We noticed in Table (7) that there were significant differences in the number of ears per plant. The control treatment had the lowest average number of ears, which was (186 m2), while the treatment sprayed with 2 liters of humic acid/dun am had the highest number, which was (227 m2). The results in the same table also showed that the control treatment had the lowest average number of ears, which was (196 m2). The table shows that there is a significant difference in the number of plant spikes in terms of the interaction, as the comparison treatment had the lowest value (183 m2), compared to the treatment with the highest mean value (spraying with seaweed extract 150 mg/L-1). While the treatment (spraying the plants with 2 liters of humic acid per dun am and 150 mg of seaweed extract per liter) gave the highest value (254 m2).

Table (7) The effect of spraying humic acid, seaweed extracts and their interaction on the number of spikes (m2).

(Number of spikes (m2)				Seaweed extracts mg/L-1
Humic acid liter/acre-1				
Average	2	1	0	
196	207	198	183	0
205	221	209	186	100
224	254	229	191	150
	227	211	186	Average
13,11 Interaction		10,15 algae extracts	10,15 Humic	L.S.D

Discussion

As shown in Tables 2, 3, 4, 5, 6, and 7, the results showed that there were significant differences in the soil and plant characteristics studied. The results showed the positive effect of humic acid on the uptake of various nutrients by plants, as it can improve the utilization and transfer rate of nutrients, especially micronutrients. Humic acid also absorbs phosphate ions, modifying them and making them more readily available to plants (Lutzow et al., 2006). Humic acid is also considered

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a reservoir for many nutrients, increasing their efficiency in plant uptake (Abdel-Mawgoud, 2007). The improvement of the above traits may be attributed to the presence of a large number of amino acids and cytokines in the seaweed extract, as well as octapeptides that play an important role in cell division. In addition, they play an effective role in life and physiological processes and have a positive impact on the growth of plant roots (Abdel-Jabir et al., 2012) The interaction between humic acid and seaweed extract also showed a significant improvement in the effects of some soil physical and chemical properties and some plant nutritional growth indicators. This improvement may be attributed to the enhanced effect of humic acid on some soil physical and chemical properties, biological traits and fertility. and its effect on exchange capacity, thereby increasing nutrient availability, improving soil properties and aeration, and promoting root growth, thereby promoting plant growth

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