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EFFECT OF BIO-FERTILIZATION AND THE ADDITION OF HUMIC AND FULVIC ACID IN AVAILABILITY OF PHOSPHORUS, SOME MINOR ELEMENTS IN SOIL AND GROWTH OF WHITE MAIZE PLANT, *SORGHUM BICOLOR* L.

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Abstract

A field experiment was conducted in Al-Muthanna province on the Swirling Riverside during the spring season 2017. A field experiment was conducted by Randomized complete Block design (RCBD) by three replicates to study the effect of the addition of acidic humic, fulvic and bio-fertilizer in the Availability of P, iron, zinc and manganese in the soil,uptake it in plant,dry matter and seedweight white corn plant. Four treatments of humic and fulvic acid were used as additive: no acidic addition (H_0), 8 liters of ha^{-1} (H_1), 16 liters of ha^{-1} (H_2), 24 liters of ha^{-1} (H_3). (B_0), bio-fertilizer containing *Bacillus subtilis* (B_1), bio-fertilizer containing *Pseudomonas* (B_2), bio-fertilizer containing bacteria *Bacillus subtilis* and *Pseudomonas* (B3) bacteria. The results showed significant superiority of B_3 in manganese in soil, phosphorus, iron, zinc, manganeseuptake in plants, dry weight of plant, grain yield and B_2 in both phosphorus, iron and zinc in the soil. The results also showed that H_3 exceeded phosphorus, iron, zinc and manganese in soil, phosphorus, iron, zinc, manganeseuptake in plant, dry weight of plant and grain yield. And H_2 in phosphorus uptake in the plant. The B_2H_3 interaction was significantly higher in both phosphorus, iron and zinc in the soil and interaction B_3H_3 in the manganese-prepared soil, iron and manganese uptake in the plant, grain yield and intraction B_3H_2 exceeded in both phosphorus and zinc uptake in the plant and dry weight in the plant.

Key words : Humic and fulvic acid, minor elements, white maize, bio-fertilizer.

Introduction

In recent decades, research and studies have focused on the use of modern technologies aimed at increasing agricultural production and reducing environmental pollution (Organic agriculture), which uses organic fertilizers and beneficial microorganisms to provide access to high productivity of agricultural produce, healthy and safe food and reduction in environmental pollution It is a substitute with time for chemical fertilizers (Shahat, 2007). Humic acids are active elements in the soil and have an important role in converting manure into soft and available-to-plant nutrients. Humic acid is an organic, fertilized and active organic fertilizer that increases the speed of plant growth and is derived from carbonate-derived humic acids. The use of humic fertilizers instead of mineral fertilizers is one of the means used to reduce the pollution resulting from the use of processed mineral fertilizers. Humus is a rich source of nitrogen and phosphorus and contains vermiculite and vermiculite acids (Verkaik, 2006). In recent decades, the use of the bio-fertilization system has spread in various parts of the world, including the Middle East. This system depends on the addition of certain species of microorganisms useful in the form of vaccines to the soil or treated seeds after isolation of these organisms and classification according to scientific methods and use as bio-fertilizers Bacterial or fungal, or both (Al-Jawthari *et al.*, 2011). Biofertilizer is a substance that contains organisms added to seeds or to the soil in the rhizosphere that stimulate plant growth and nutrient availability, as well as its role in reducing mineral fertilizers. It is environmentally friendly and non-polluting, producing healthy food (Kumar *et al.*, 2013).show (Shammari, 207).

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

pH	Ec.e	OM	Available	Available	Available	Available	Available	Available	Sand	Silt	Clay
7.8	3.4	13.8	22.1	13.8	172.4	2.40	0.68	0.34	193.2	441.5	365.3
									loamy		
1.1	ds.m^{-1}	g kg^{-1}	kg^{-1}mg	kg^{-1}mg	kg^{-1}mg	µg gm^{-1}	µg gm^{-1}	µg gm^{-1}	gm kg^{-1}		

Analyzes were conducted in the laboratories of the Faculty of Agriculture, Al-Muthanna University.

The bio-fertilization and fertilization with hemic acid resulted in a significant increase in the total mass relative to the comparison treatment due to the increased Availability of many nutrients in the soilMany researchers concluded that fertilization (organic and bio) was associated with the best concentration of available-to-feed nutrients in soil when cultivating with different crops (Datta *et al*., 2009). The study aim is to effect of acidity of humic and fulvic acid, *Bacillus subtilis* and *Pseudomonas* bacteria and their intraction in nutrient availability in soil and production of white maize plant.

Materials and Methods

Land preparation and service operations

A field experiment was conducted in Al-Muthanna Governorate on the River Sawir during the 2017 season. The field soil was plowed with a 25-cm plow plow and was softened by the disk harrows. The main and subsidiary sediments were then opened and then divided into three sectors (one unit included 16 experimental units, experimental unit area 6 square meters (3 × 2), the experimental units included three lines with a length of 3 m and a distance between 70 cm and 70 cm. added Phosphate three (20%P), Potassium sulphate (41% K) for soil before planting and as a single batch and nitrogen 240 kg N ha^{-1} in the form of urea fertilizer (46% N) was added in two batches, the first after a week of planting and the second after a month of the first batch (6 and 5). All the service operations were performed equally for all experimental transactions in the study, and whenever needed.

Analysis of soil samples

Random samples were taken from the soil of the field before planting at a depth of 0-20 cm, then a homogeneous mixture was mixed and chemical and physical analysis was performed (table 1).

Add bio-fertilizer application

The bio-fertilizer was used in the Microbiology Laboratory at the Faculty of Agriculture of Al-Muthanna University, where bacterial isolates of Bacillus subtilis and Pseudomonas (1 kg per 10 kg seeds) were used in the fertilization (Muraleedharan *et al*., 2010). With distilled and sterilized water and the addition of gum arabic to ensure adhesion of the vaccine with seeds and then carried with a metal holder obtained from the Ministry of Science and Technology and left for half an hour before planting (Bashan *ety al.,* 1993). Add organic fertilizer (Humic and fulvic acid).Liquid organic fertilizers were obtained commercially from German Leonard Dite, which has some qualities.Humic and Fulvic acids were added at concentrations 0, 8, 16 and 24 liters ha^{-1} after 30 and 60 days of germination using an afternoon spray to avoid high temperatures.

Study factors

Biofertilizer 1-, Do not add (B_0), Addition of *Bacillus subtilis* bacteria (B_1), Adding *Pseudomonas* bacteria (B_2), Addition of bacteria *Bacillus subtilis* + *Pseudomonas* bacteria (B_3), Humic, fulvic acid 2-, the addition of humic and folvic acid. Add 0 (H_0), 8 (H_1), 16 (H_2) and 24 (H_4) liters ha^{-1} . Three replicates were made to become the number of experimental units4×4×3=48 experimental units.

Agriculture and crop service operations

The seeds of the white maize were grown on 2/3/2017 and in the form of three lines per plate and with a seed quantity of 9.6 g, experimental unit, 16 kg per hectare. The irrigation process was done immediately after planting, adding water to reach the field capacity after depletion 50% of the available-made water and moisture content was maintained throughout the growing season and in the weightwise manner. Add acidic, humic and fulvic in soil to soil after 30 and 60 days of planting. Dysinone herbicide with 10% concentration (5 kg h^{-1}) was used to fight the Sesamiacretica for the first two times after 20 days of germination and the second after 15 days of the first control by adding it in the heart of the fourth leaf (Ministry of Agriculture, 2006). Harvesting the maize crop on 15-7-2017, when signs of maturity appear.

Soil analysis after agriculture

Soil samples were taken from each experimental unit and from five sites representing the growth environment of the roots (the soil adjacent to the roots). After harvesting the plants, the samples were well mixed to be

Table 2 : Some components of liquid organic fertilizer.

Component	Content	Unit
Humic acid	80	%
Fulvic acid	17	%
Organic matter	70	%
Potassium(K_2O)	3	%
Iron	0.3	%
pH	10.5-9	-
Density	1.12	Kg L^{-1}

homogenized and suitable soil weight was taken for analysis and estimation of the phosphorus, iron, zinc and manganese availability. Field measurements of some plant.

1. Dry weight of the vegetative part

The five plants were then cut and then dried and then dried in the oven at 65°C until the weight was stable. The dry weight of the plant was calculated and dry weight was calculated per hectare.

2. Grain yield

According to the grain yield on the basis of metric tons ha^{-1} (mega gram ha^{-1}) after weight adjustment on the basis of moisture 15.5% and the total production value according to the Sahuyki and Karim (1990).

Statistical analysis

The results of the experiment were statistically analyzed according to the method of analysis of variance of the design used in the study. Moral differences were calculated between the mean of the coefficients with the lowest difference at 0.05 (Sahuyki and Karim, 1990) using the Genstat-Version5 program in the statistical analysis.

Results and Discussion

Phosphorus available in the soil

Table 3 shows the significant effect of the addition of bio-fertilizer B_2 and B_3 on soil phosphorus Availability, with an increase in phosphorus concentration in the soil of 17.93% and 11.61% compared with the non-addition of B_0. This may be due to the ability of Bacillus and Pseudomonas alone as a mixture in increasing the phosphorus availability through its production of organic acids, which helps to reduce the degree of soil interaction, which leads to the increasing melting of low phosphorus compounds and thus increase the Availability of phosphorus (Wilheim *et al*., 2007; Al-Bahrani, 2015). The increase in soil concentration of phosphoric acid significantly increased the concentration of phosphorus in the soil by increasing levels of H_1, H_2, 19.94, 60.25% and H_3 35.29%, respectively, compared to H_0. This may

Table 3 : Effect of bio-fertilization, added humic and fulvic acid in phosphorus availability in soil (mg P kg^{-1} soil).

Biofertilizer	Humic and fulvic acid				Mean
	H_0	H_1	H_2	H_3	
B_0	19.02	23.65	25.55	26.16	23.59
B_1	20.10	24.89	27.00	27.89	24.97
B_2	24.22	27.80	27.30	31.99	27.82
B_3	22.10	26.17	27.49	29.58	26.33
Mean	21.36	25.62	26.83	28.90	
L.S.D	B=0.93	H=0.93	B×H=1.78		

be due to the effective role of humic acids in reducing the processes. Deposition and adsorption of phosphorus on the surface of colloids due to competition on adsorption sites, which increases the release of phosphorus into the soil solution, as well as the slow dissolving and persistence of phosphorus minerals in the soil by addition of humic acids (Abdel–Razzak and El–Sharkawy, 2013). Interaction between biofertilizers and soil additive for humic and fulvic acid is shown in table 3 Both B_2H_3 and B_3H_3 did not differ significantly in phosphorus concentrations in the soil, but they were significantly higher on all treatments with an increase rate of 68.19% and 55.52% respectively compared to B_0H_0, This may be due to the effect of bacteria on the reduction of soil reaction due to production of organic acids or the production of phosphatase, which helps in the release of phosphorus in the soil and the ole of humic acids in increasing the number and rapid growth of microorganisms in soil (Bano and Musarrat, 2003; Burkowska and Wonderski, 2007).

Available iron in soil.

Table 4 shows the effect of bio-fertilization on iron Availability in the rhizosphere area. The results of the table show the increase of available iron in the soil with the addition of bio-fertilizer and a significant difference from the comparison. The ratio of available iron to coefficients B1, B2, B_3 3.38, 4.75 and 4.33 mg Fe kg^{-1} soil respectively, while the ratio of B0 (no bio fertilizer) was 1.44 mg Fe kg^{-1} soil with increase rates of 42.01%, 99.57% and 81.93%, respectively. This may be due to the role of bacteria used as bio-fertilizer in their capacity On the production of materials that increase the retention of iron in dissolved complexes or the ability of these bacteria to produce organic acids that help reduce thedegree of soil reaction of the rhizosphere area, which increases iron available (Bakker *et al*., 2007; Marschner *et al*., 2010; AL-Zahedi, 2015). The H_3 level of humic acid and fulvic acid was significantly higher in the concentration of iron availability in the soil at the levels of H_2 and H_1, both of which significantly exceeded the H_0 level. As the iron available for them in the soil 4.80 and 4.18 and 3.41 and 2.45 mg Fe kg^{-1} soil respectively, may be due to the ability of humic acids added to the soil in reducing the degree of soil interaction, leading to reduction of the iron to iron and then the iron and iron Most readily available for iron in soils (Yaseen *et al*., 2007; Aroncon *et al*., 2008). Biodegradation between acid fertilization and addition of acidic humic and fulvic acid had a significant effect on iron uptake in the soil and B_2H_2, B_2H_3 and B_3H_3 showed the highest increase in iron Availability. The ratio of available-made iron in the soil was 5.21, 5.72 and 5.41 mg Fe kg^{-1} soil respectively This may be due to the fact that the addition of compost with bio-manure improved the properties of soil and increased the concentration of elements (iron, zinc, manganese, nitrogen, phosphoruspotassium) and others (Al-Barakat, 2016). This may be due to the ability of humic acids to provide the energy needed to produce the tea (Neilands, 1984).

Available zinc in soil.

The results of table 4 showed the effect of bio-fertilization on the availability of zinc in the soil, showing significant superiority of the B_2 treatment. The zinc ratio in the soil was 0.592 mg Zn kg^{-1} soil on B_1 and B_3 which were not significantly different. And 0.504 mg Zn kg^{-1} soil, respectively. Compared to the comparison treatment of zinc concentration in the soil with 0.442 mg Zn kg^{-1} soil. This may be due to the effectiveness and activity of the bacteria used as biomass in dissolving zinc from its insoluble compounds such as zinc carbonate in lime soils (Mishra and Dash, 2014). In addition, humic and fulvic were significantly affected by the increase in zinc in the soil. Zinc increased with the increase in the level of addition. The level of addition of H_3 of humic acid and fulvic significantly increased at H_2 level, both of which were significantly higher at H_1 level and achieved an increase rate of 78.13% and 51.20% and 28.00%, respectively, compared to the H_0 comparison treatment. This may be due to the fact that the addition of humic acids improves the physical, chemical and fertility properties of soil as well as their high ability to reduce soil reaction, which has a direct effect on increasing the Availability of many nutrients in the soil (Mauromicale *et al*., 2011; Al-Barakat, 2016). Binary interactions between Biofertilizers and humic acid and fulvic, with zinc in the soil at the highest levels of B_2H_3 and B_3H_3, 0.746 and 0.703 mg Zn^{-1} soil and 0.311 mg Zn kg^{-1} soil at B_0H_0. This is due to the positive role of added humic acids and bio-fertilizer used to increase zinc-available soil (Zhoa *et al*., 2007).

Available manganese in soil

Table 4 shows the effect of bio-fertilization on manganese Availability in soil, with significant differences between B_1, B_2 and B_3, with a mean of 0.331, 0.340 and 0.354 mg mn kg^{-1} Soil significantly superior to B_0, Soil preparation has 0.251 mg mn kg^{-1} soil. The addition of humic and volcanic soil, which has a significant effect on manganese uptake in soil, may be due to increased manganese Availability with increased level of addition. H_3 and H_2 are significantly higher in H_2 than both on the level H_1 and the increase rates were 81.77%, 45.33% and 9.74%, respectively, compared with the H_0 comparison treatment. This may be due to the fact that the addition of humic acids improves the physical, chemical and fertility properties of soil as well as their high ability to reduce the soil reaction, which has a direct effect on increasing the availability of many nutrients in the soil (Al-Bahrani, 2015; Al-Barakat, 2016). Interaction between biofertilizer and addition of acidic humic and fulvic showed that B_1H_3, B_2H_3 and B_3H_3 were superior in manganese availability in soil at 0.452, 0.470 and 0.484 mg mn kg^{-1} soil while 0.215 mg mn kg^{-1} soil were treated with B_0H_0. This is due to the positive role of added humic acids and bio-fertilizer used in the increase of manganese-available soil (Al-Bahrani, 2015).

Phosphorus uptake in the plant

Table 5 shows the effect of bio-fertilization and the addition of acidic humic and fulvic acid in the amount of phosphorus uptake by the white maize plant. The results of the table showed that the addition of bio-fertilizer B_3 and B_2 in phosphorus uptake increased by 24.86% and 11.72% respectively, B_0, while B_1 did not differ significantly with B_0. This may be due to the fact that phosphate soluble bacteria dissolve and process phosphorus from dissolving insoluble phosphate compounds in the soil solution and from organic phosphorus processes in the soil, resulting in an increased uptake of the plant. The effect of additive biology is demonstrated by its efficiency in the production of organic acids and its phosphatase effect, which increases phosphorus uptake in soil and uptake by the plant (Bano and Musarrat, 2003; Afzal *et al*., 2005). Results of Table 5 did not differ between the treatments H_2 and H_1 of the addition of humic acid and fulvic between them, but significantly higher than the treatment of H_1, which in turn significantly exceeded the treatment of H_0. The percentage increase in the average phosphorus uptake 30.18% and 28.66% and 17.75% on the relay by measurement For the treatment of H0, which has an average phosphorus uptake 19.15 kg P ha^{-1}. This may be due to the role of organic acids added to the soil in the reduction of the degree of reaction of the center or due to contain the groups of phenolic or carboxylic have the status of calcium moss and the release of phosphorus as well as a rich source of phosphorus Which increases its Availability and thus increases (Leytem and Mikkelsen, 2005; Verkaik, 2006). Bilateral interaction of the experimental parameters and the results of table 5showed that B_3H_1, B_3H_2, B_3H_3, B_2H_3 and B_2H_2 significantly exceeded the average phosphorus uptake in all treatments. The phosphorus uptake rate was 25.93, 28.76, 27.51, 25.54 and 25.29 kg P ha^{-1} B_0H_0 treated with phosphorus uptake 17.55 kg P ha^{-1}, which is the lowest rate. This is due to the ability of Bacillus and Pseudomonas in the production of many organic acids and enzymes that help in the dissolution of some compounds to be available image by the groups of carboxyl and hydroxyl of these acids and emulsion of ions, especially calcium, in lime soils. On the other hand, the secretion of organic acids has a significant role in reducing the soil pH to help increase the Availability of many elements, including phosphorus, which helps in the ease of uptake of the plant or may be due to the addition of acidic Humicand fulvic lead to increased continuity The effect of the bacteria added as a vaccine is therefore reflected on phosphorus uptake and uptake positively (Kim *et al.*, 1997).

Uptake iron in the plant

Table 6 shows the effect of bio-fertilization and the addition of acidic humic and fulvic in the amount of zinc uptake by maize plant. Table 6 shows the effect of the addition of bio-fertilizer in iron uptake. The treatment B_1 did not differ significantly with the treatment of the addition of bio-fertilizer B_0, while the treatment of B_3 and B_2 was the greatest moral effect In the uptake of iron in the plant with an increase rates of 24.43% and 10.79% on the relay in relation to the treatment B0. This may be due to the efficiency of bacteria used as bio-fertilizer in the production of high-fiber sidroforsat in the iron bonding in the soil formed by available-to-absorbent complexes by the plant (38).The results showed that iron uptake in the plant was not significantly different for H_2 and H_3 levels for hemic and fulvic acidity, but they were significantly higher at the level of addition H_1, all of which exceeded H_0 with an increase of 28.12%, 33.75% and 20.62%, respectively. The addition of acidic humic and fulvic acid to the plant increases the uptake of many nutrients, including iron, due to the increase of root branches as root hair increases, which increases the surface area and facilitates effective uptake, as well as "it increases the permeability of the cell membrane of the roots, The effect of the hormone and its role in the formation of complexes with metal ions, which increases the solubility and Availability of these elements to the root of the plant The results were agreed with the results of Zahir *et al* (2004), which found that the addition of humic acid to the soil led

Table 4 : Effect of bio-fertilization, humic acid and fulvic acid in iron, zinc and manganese availability in the soil (mgkg^{-1} soil).

Biofertilizer	Humic and fulvic acid				Mean
Iron					
	H_0	H_1	H_2	H_3	
B_0	1.44	1.95	2.45	3.70	2.38
B_1	1.76	3.18	4.22	4.39	3.38
B_2	3.53	4.54	5.21	5.72	4.75
B_3	3.09	3.98	4.87	5.41	4.33
Mean	2.45	3.41	4.18	4.80	
L.S.D	B=0.45	H=0.45	B×H=0.87		
Zinc					
	H_0	H_1	H_2	H_3	
B_0	0.311	0.411	0.471	0.575	0.442
B_1	0.378	0.460	0.543	0.650	0.507
B_2	0.423	0.586	0.614	0.746	0.592
B_3	0.389	0.464	0.640	0.703	0.504
Mean	0.375	0.480	0.567	0.668	
L.S.D	B=0.025	H=0.025	B×H=0.044		
Manganese					
	H_0	H_1	H_2	H_3	
B_0	0.215	0.231	0.249	0.311	0.251
B_1	0.227	0.248	0.361	0.452	0.331
B_2	0.238	0.281	0.371	0.470	0.340
B_3	0.264	0.277	0.394	0.484	0.354
Mean	0.236	0.259	0.343	0.429	
L.S.D	B=0.017	H=0.017	B×H=0.041		

Table 5 : Effect of bio-fertilization, hemic acid and fulvic acid in phosphorus uptake in plant (kg P ha^{-1}).

Biofertilizer	Humic and fulvic acid				Mean
	H_0	H_1	H_2	H_3	
B_0	17.55	20.44	22.78	21.45	20.55
B_1	19.34	22.10	22.90	24.09	22.09
B_2	19.27	21.76	25.29	25.54	22.96
B_3	20.45	25.93	28.76	27.51	25.66
Mean	19.15	22.55	24.93	24.64	
L.S.D	B=1.72	H=1.72	B×H= 2.35		

Table 6 : Effect of bio-fertilization and acidic humic and folvic in iron, zinc and manganese uptake in plant (kg ha^{-1}).

Iron					
Biofertilizer	Humic and fulvic acid				Mean
	H_0	H_1	H_2	H_3	
B_0	1.38	1.83	1.88	1.95	1.76
B_1	1.60	1.88	1.92	1.94	1.83
B_2	1.66	1.87	2.08	2.19	1.95
B_3	1.79	2.17	2.32	2.51	2.19
Mean	1.60	1.93	2.05	2.14	
L.S.D	B= 0.09	H=0.09	B×H= 0.19		
Zinc					
Biofertilizer	Humic and fulvic acid				Mean
	H_0	H_1	H_2	H_3	
B_0	0.143	0.209	0.217	0.297	0.216
B_1	0.174	0.245	0.314	0.320	0.263
B_2	0.197	0.259	0.301	0.304	0.266
B_3	0.265	0.329	0.432	0.373	0.394
Mean	0.194	0.260	0.318	0.323	
L.S.D	B=0..027	H= 0.027	B×H= 0.043		
Manganese					
Biofertilizer	Humic and fulvic acid				Mean
	H_0	H_1	H_2	H_3	
B_0	0.105	0.129	0.155	0.143	0.133
B_1	0.123	0.153	0.168	0.164	0.152
B_2	0.136	0.153	0.171	0.187	0.161
B_3	0.178	0.219	0.222	0.261	0.195
Mean	0.135	0.163	0.179	0.188	
L.S.D	B= 0.016	H= 0.16	B×H=029		

to the increase concentration of some micronutrients In leaves of yellow corn plants such as iron and zinc . As for the binary interaction between the biomass and the soil addition of the humic and the fulvic acid, the results of table 6 showed that B_3H_2 and B_3H_3 did not differ significantly between all the remaining treatments, with the highest mean iron uptake of 2.32 and 2.51 kg Fe ha^{-1} respectively, while the rest of the treatments. The B_0H_0 was significantly overpowered by different growth rates. This may be due to the effect of biocides as biomass or microorganisms already present in the soil or to the ability of humic acids to reduce the degree of soil interaction in the rhizosphere area, which results in increased iron availability in the soil, which increases its uptake by the plant or may be due to the role of the mixture which is characterized by humic acids, which ferment the iron and keep it from sedimentationand stabilization (Aroncon *et al*., 2008; Roemheld, 1991).

Zinc uptake in the plant

The results showed that B_1 and B_2 were significantly correlated with zinc uptake, with 21.75% and 23.14% respectively. The best uptake rate for zinc was treated with B_3, with an increase of 82.40% compared to the non-addition of B_0. The ability of the bacteria added as a bio-fertilizer on the release of organic acids, which is reflected in reducing the degree of soil reaction in the area of the rhizosphere and thus dissolving and processing of micronutrients, especially zinc or perhaps the release and processing of zinc ZnO, ZnS, $ZnCO_3$ compounds in the soil and thus available in the soil (Samoon *et al*., 2010; Mishra and Dash, 2014).Treatments H_1, H_2 and H_3 were significantly increased by 34.02%, 63.91% and 66.49% in relation to H_0. This increase may be due to the ability of humic acids added to the formation of zinc complexes as a result of containing the functional aggregates that emit zinc ions a high governorate of adsorption and sedimentation and then transfer to the roots of the plant as a result of the difference in charge between the root and ions. The humic acids act as the carrier of the nutrients from the soil to the plant (Al-Bahrani, 2015). Bilateral interactions between bio-fertilizer and soil additive to the acidity of the humic and fulvic acid significantly affected the increased zinc uptake by the white maize plant. The results showed that B_3H_2 had a significant effect on all remaining treatments, with the highest mean zinc uptake of 0.432 kg Zn ha^{-1} while the lowest zinc uptake rate was at 0.143 kg Zn ha^{-1}. This is due to the positive effects of humic acid and fulvic acids in increasing the availability of micronutrients, including zinc, as well as the positive effect of stimulating the soil's bio-efficiency, increasing its activity in the rheosphere and affecting micronutrient availability (Al-Barakat, 2016).

Manganese uptake in the plant

Table 6 shows the effect of bio-fertilization and the addition of acidic humic and fulvic acid in the amount of manganese uptake by the white maize plant. The table showed significant differences in B_1, B_2 and B_3 in manganese uptake, with 14.28%, 50.14% and 46.61%, respectively. For bio-fertilizer B_0 Treatments H_1, H_2 and H_3 were not significantly different in manganese uptake from white maize, achieving significant increase of 20.74%, 32.59% and 39.25% compared with H_0 This increase may be attributed to the positive role of humic acids added in soil degradation helping to increase the availability of micronutrients, including manganese. Bilateral interactions between biomass and soil additive for the humic acid and fulvic acid significantly affected the increase in manganese uptake by the white maize plant. The results showed that B_3H_1 and B_3H_2 did not differ significantly between the two treatments, but they were significantly higher than all the remaining treatments except B_3H_3, which had the highest mean manganese uptake rate of 0.163, 0.179 and 0.188 kg Mn ha^{-1}, while the lowest rate of zinc uptake was Comparative treatment B_0H_0, which amounted to 0.135 kg Mn ha^{-1}. This is due to the positive effects of humic, fulvic and microorganisms in increasing the availability of micronutrients as a result of their secretion of organic acids, which dissolves the compounds of these nutrients.

Dry weight

The results of table 7 indicate that B_1, B_2 and B_3 manure coefficients were not significantly different in the dry weight of the white maize crop, but significantly increased by 17.17%, 18.86% and 28.98% respectively with B_0. This increase may be attributed to the work of microorganisms added to different mechanisms and mechanisms, including the solubility of some nutrients from their insoluble compounds in the soil as well as the release of some organic acids and some hormones and growth regulators that affect cell division and stimulate plant growth. These secretions support plant growth (Tahir *et al*., 2011). The results in table 7 also showed that the difference in acidity of humic, fulvic added to levels H_2, and H_3 was significantly increased by dry weight of 22.41%, 46.89% and 53.62% respectively with dry weight at H_0 level. The interaction of the bio fertilizer and the addition of acidic humic and fulvic exceeded the coefficients B_2H_3, B_3H_2 and B_3H_3 and significantly on all the treatments achieving the highest rate of this interference, which amounted to 9.55 and 10.02 and 961 mega gram ha^{-1} on the relay, the rest of the transactions were different significance in relation to treatment B_0H_0, dry weight 5.39 mega gram ha^{-1}. The increase in dry weight may be attributed to the role of bio-fertilization in increasing nutrient availability in the soil as well as the ability of these microorganisms to develop and increase the root mass, which was positively reflected in the increased uptake of the elements and increased dry weight of the plant. The role of organic acids and their role in increasing the Availability of nutrients in the soil, which has a positive effect on the development of the growth vocabulary of the plant ofZea maize and thus increased the value of dry matter. The results agree with Al-Bahrani (2015).

Grain yield

The grain yield in the unit of area is the target of the product and the total grain yield is the most important field scale that gives the final evaluation of the experimental factors used (Dwyer and Tollenaar, 1989). The results in Table 8 show the significant increase in grain yield when adding bio-fertilizer B_2 and B_3, which did not differ significantly between them. The grain yield reached 6.02 and 5.77 mega gram ha^{-1}, achieving an increase rate of 15.40% and 20.40% B_0, which had a grain yield of 5.00 mega gram ha^{-1}, which did not differ significantly with the treatment of B_1, which amounted to the grain treatment then 5.34 mega gram ha^{-1}. This increase was attributed to the effect of the effectiveness of these organisms in their secretions of organic materials and enzymes to activate the work of existing nitrogen. Originally in the soil which increases the proportions of protein in the amalgam. The addition of humic acid and wolfic acid significantly increased the yield of white maize grains compared to the non-fertilized treatment. The levels of H_1, H_2 and H_3 of hemic acid and fiber added added the highest grain yield of 5.39 and 6.00 and 6.24 mega gram ha^{-1} respectively, Was 4.51 mega gram ha^{-1} in the treatment of non-fertilization of acid. It may be due to the fact that the acid and hemp and the follicle processed the nutrients of the plant through the formation of complex compounds dissolved and ready to absorb (Al-Barakat, 2016). The results of the table showed that B_2H_2, B_2H_3, B_3H_2 and B_3H_3 were not significantly different, but achieved the highest rates of white maize grains of 6.43, 6.58, 6.51 and 6.74 mega gram ha^{-1} in the sequence, while the lowest grain yield was 4.30 mega gram ha^{-1} at the treatment of B_0H_0, while the rest of the transactions

Table 7 : Effect of bio-fertilization, humic acid and fulvic acid in dry weight (mega gram ha^{-1})

Biofertilizer	Humic and fulvic acid				Mean
	H_0	H_1	H_2	H_3	
B_0	5.39	6.16	6.78	7.77	6.52
B_1	5.84	7.54	8.50	8.71	7.64
B_2	5.69	7.00	8.79	9.55	7.75
B_3	6.30	7.71	10.02	9.61	8.41
Mean	5.80	7.10	8.52	8.91	
L.S.D	B=0.96	H= 0.96	B×H=1.25		

Table 8 : Effect of bio-fertilization, hemic acid and folvicacid in grain yield (mega gram ha^{-1}).

Biofertilizer	Humic and fulvic acid				Mean
	H_0	H_1	H_2	H_3	
B_0	4.30	4.66	5.52	5.55	5.00
B_1	4.47	5.26	5.56	6.09	5.34
B_2	4.43	5.65	6.43	6.58	5.77
B_3	4.84	6.02	6.51	6.74	6.02
Mean	4.51	5.39	6.00	6.24	
L.S.D	B=0.36	H=0.36	B×H=0.51		

varied in terms of morale. This is due to the vital role in increasing the number of crops. This is due to the importance of the use of bio-fertilizers in the provision of some of the important nutrients of the plant or the positive role of humic and fulvic acid in the effectiveness of enzymes, phytonutrients and metabolism may lead to a high amount of carbohydrates for most plants (Wheat - corn - rice - potato ....), which has an impact on the production of plants and the increase grain yield (Kumar, 2010).

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