Nat. Volatiles & Essent. Oils, 2021; 8(6): 547-557

The Effect Of Potassium Fertilization And The Addition Of Humic Acid On The Growth And Yield Of Wheat Crop Under Different Levels Of Salinity Of Irrigation Water

Karar Hussein Mazal[1] , Abdul Karim Hassan Atafa[2] , Nabil Rahim Lahmoud[3]

[1.2]College of Agriculture, University of Wasit, Department of Soil and Water Sciences, Iraq

[3]College of Agriculture, Wasit University, Department of Field Crops Sciences, Iraq

Abstract

The experiment was carried out in the autumn season (2020-2021) in the fields of the College of Agriculture - Wasit University in order to know the overlapping effect of salinity stress, humic acid and potassium on the wheat crop, Buhuth class 22. A factorial experiment was implemented using a completely randomized design (CRD) with four repetitions for each treatment in which three levels of salinity of irrigation water were used and symbolized (1.2 S1 = 3, S2 =, 6 S3 = decimens) on the sequence and two levels of potassium fertilizer (150 K1 = and 250 K2). = kg K H -1 Humic acid was added (0.02%) by different methods of addition, namely: ground addition HT, foliar application HF and combined addition HFT and the total amount was divided into three stages of growth (branching, elongation, flowering).The results showed the superiority of S1 treatment. (1.2 decims) significantly in plant height (52.56 cm), weight of 1000 grains (47.21 g), number of spikes in the pot (20.92 spike spikes^{-1}) and weight of grains in pot, while the treatment of saline water S3 recorded the least significant difference for all of the above traits. For the second level of potassium K2 in plant height (63.58 cm) and weight of 1000 grains (43.97 g), the number of spikes in the pot (18.78 pot spikes^{-1}) and the weight of grains (55.61 kg pot^{-1}), while the first treatment of potassium K1 showed the least significant difference for all of the above traits. The results showed a significant superiority of the HFT co-additive in ART the plant high (67.00 cm) and the weight of 1000 grains (49.06 g), which does not differ significantly from the ground addition HT, while the comparison treatment H0 showed the least significant difference for all the above traits. The ground addition of humic also achieved a significant superiority in the number of spikes in the pot (19.83 gm pot^{-1}) and weight. Cereals (6.35 tons H^{-1}) and grain weight (56.89 gm pot^{-1})

Introduction

The demand for agricultural production increases annually due to population increase, and therefore the demand for fresh water, of which agriculture is the primary consumer, as well as for human and industrial uses has increased. With the increasing need for fresh water, this water suffers from a great shortage of its resources, which requires more search for other sources of water, perhaps of poor quality, such as sewage or sewage after treatment (Al-Jilani, 1997). The use of this water over time may lead to many adverse effects on the soil or agricultural product, such as the accumulation of salts in the soil, an increase in the osmotic pressure of its solution, or a change in some chemicals. Soil physical and biological properties. Its effect may be evident in the availability and availability of nutrients to plants, as well as its effect on the activity of microorganisms within the soil (Al-Zubaidi, 1989). It may require the adoption of some techniques for the management of saline water in proportion to the ability of the crop to live with it; including cultivation of resistant cultivars, transfer of genes responsible for salt tolerance, use of growth regulators or hemic acids such as humic acid (Al-Mashandi et al., 2017). Extensive use of mineral fertilizers and in thoughtful ways may lead to soil degradation and pollution in the long run, which calls for the use of organic fertilizers that restore soil fertility. Among those fertilizers used are some organic acids produced naturally from different organisms, and these acids are a natural mixture with a high molecular weight and contain a number of active and activating groups that increase the speed of growth by improving some properties of the material. Soil, such as its ability to exchange cations or through its action as a chelating substance, preserves nutrients in the soil and prevents them from being lost or reformed until the plant can use them. These elements are mainly involved in building the structure of the plant and the formation of its tissues, as well as in the formation of amino acids, which are the basic units for the production of protein and energy, as well as their role in reducing soils. pH. By producing hydrogen ion upon decomposition (Ali et al., 2014), increasing numbers of beneficial microorganisms in the superficial layer surrounding the roots, increasing plant uptake capacity and extreme resistance to environmental conditions such as high temperatures, salinity and penetration of cell membranes (Shalash et al., 2011). It also leads to an increase in the ability to grow and improve the root system by increasing its weight and number of branches (Reform, 2010) in addition to the loosening of heavy soil granules, improving their properties and destroying them. Of clay particles and heightAir permeability, water movement, root spread, preservation of soil heat and moisture, and increased water holding capacity. The amount of potassium ready in the soil is higher than the critical limit, and the Iraqi soil can be characterized by a large storage of potassium, as is the case for most soils of dry and semi-arid regions (Al-Obaidi, 1996 and Al-Samarrai 2005), but the speed of its release is relatively low and does not meet the amount required for the crop. Especially for plants that need it most. Although there is a store of it in the soil, the addition of fertilizers increases the response of the crop (Al-Saadi, 2007). Researchers have resorted to adopting modern techniques in irrigation or fertilization for this crop, through which it is possible to narrow the gap between lack of production and increased demand to secure food needs in conditions of water shortage in the country. Hence, this study was developed in order to study the effect of adding different levels of potassium fertilizers and humicacid and the methods of adding them on some characteristics of vegetative growth and yield of wheat plants under irrigation conditions at different levels of irrigation water salinity.

Materials and methods

The experiment was conducted in the fall semester (2020-2021) in the fields of the College of Agriculture - Wasit University with the aim of knowing the effect of the interaction of salinity stress, humic acid and potassium on the yield of Boho Class 22 wheat, taken from a depth of 0-30 cm to estimate the chemical and physical properties and classified according to the American classification Talking to the lowest level for large groups within the rank of terrible according to what was mentioned in (2006). , oil survey staff), the soil was taken from the surface layer in the Al-Hussainiya area, north of Wasit Governorate.

Experiment design

A factorial experiment was conducted using a complete randomized design (CRD) and four replicates for each treatment (96 experimental units) were randomly distributed to the experimental units. The experiment included three factors representing the first three levels of salinity of irrigation water (1.2S1 =, 3S2 =, 6S3 = Desimens m). While the second factor consists of two levels of potassium fertilizer added 150 = 1 Kelvin H-, 250 = kg kg H-^{1}, and the third factor is the spraying of humic acid with two concentrations (0,0.2%) and by different addition methods divided into three stages of growth, namely (branching, elongation, flowering)

1. Ground addition, which is symbolized by HT.
2. Addition by spraying on the plant and symbolized by HF.
3. Mixed application (soil and plant), which is symbolized by HFT.
4. Do not add H0.

Results and discussion

Effect of levels of saline, potassium and humic acid fertilizers on plant height (cm)

Table No. (1) Shows a significant effect of potassium addition, where the highest plant height reached the K2 level of potassium 63.58 cm, while the K1 level achieved the lowest plant height of 61.92 cm. The increase in plant height with increased potassium fertilization is due to the positive role potassium plays in the accumulation of carbohydrates in the stem and the increase in the number and thickness of root nodes. All this leads to stem elongation and positively affects plant height (Das And Vig, 1977) and this is in agreement with Aktar et al. (1999) and Al-Khazraji (2011). We also note that there is a significant difference between the salinity levels of irrigation water in plant height, where the highest average plant height reached S1 level with a height of 65.88 cm, while the lowest average height. The S3 salt water level was 59.00 cm high. We note that there are statistically significant differences when adding humic acid, where the highest average plant height for the acid addition treatment (HFT) was 67.00 cm and an increase of 14.5%, which is not significantly different from the rest of the treatment methods. Addition compared to not adding acid. (H0), which achieves the lowest average plant height of 52.56 cm. This is due to the important role that humic acids play in improving cell division and cell elongation, since humic acid has a significant effect on photosynthesis, protein synthesis and various enzymatic processes and has an effect similar to that of plant hormones. Thus, its role in the overall growth rate and improving cell growth (Kulikova et al., 2003) Kindle effect is due to the hormonal effect of humic acid because it affects the cell wall and the protoplasm surrounding the cell and thus increases the speed of cell division and increases growth and positive effect in the plant and these results were Identical with the results of (Hashim 0.18), which may prove that an increase in humic acid leads to an increase in plant height. We note from the same table that there are no significant differences for the interaction between potassium and humic acid, as the combination K2HFT achieved the highest average plant height of 68.0 cm, while the combination K1H0 achieved the average minimum plant height of 51.67 cm. We also note that the interaction between humic acid and salinity was significant, as we note that the combination S1HFT achieved the highest rate of 71.50 cm 2HFT and achieved an increase of 25.9% compared to the mixture containing fresh water without adding humic acid (S1H0). . The appropriate. No significant difference was observed for the interaction between irrigation water salinity and potassium levels, as group S1K2 achieved the highest mean plant height trait of 66.92 cm, while group S3K1 achieved lowest mean plant height 58.5 cm (Gann and Boyd, 2000). We also note from the table that there is no significant effect of the triple interaction between potassium and salinityIrrigation water and humic acid on plant height, where the results indicated that the combination S1K2HFT had the highest average plant height of 73.00 cm, while the combination S3K1H0 achieved the lowest average plant height of 50.00 cm. This may be due to the presence of nitrogen, as it is a fast-moving element within the plant and considered a mobile element with recent growth. It works on the formation of gibberellin acid, and zinc participates in the formation of auxin, which has an effect on cell division and fission. (Al-Hasnawi, 2016) and (Abdel-Khaleq, 2017) for wheat crop.

Table1 Effect of salinity levels of irrigation water, potassium fertilizers and humic acid on plant height, cm.

SXK	Humic acid				potassium	irrigation water salinity
	HFT	HF	HT	H_0		
64.83	70.00	68.00	68.33	53.00	K_1	S_1
66.92	73.00	69.67	70.00	55.00	K_2	

62.42	67.67	64.33	65.67	52.00	K_1	S_2
64.33	69.00	66.33	68.00	54.00	K_2	
58.5	60.33	63.00	60.67	50.00	K_1	S_3
59.5	62.00	62.33	62.33	51.33	K_2	
N	LSD_{S*K}	N			LSD_{S*K*H}	
	67.00	65.61	65.83	52.56	Humic acid averages	
	1.359				LSD_H	
S * H						
salinity averages	HFT	HF	HT	H_0	irrigation water salinity	
65.88	71.50	68.83	69.17	54.00	S_1	
63.38	68.33	65.33	66.83	53.00	S_2	
59.00	61.17	62.67	61.50	50.67	S_3	
1.177	LSD_S	2.353			LSD_{S*H}	
K * H						
Potassium averages	HFT	HF	HT	H_0	potassium	
61.92	66.00	65.11	64.89	51.67	K_1	
63.58	68.00	66.11	66.78	53.44	K_2	
0.961	LSD_K	N			LSD_{K*H}	

Effect of levels of saline, potassium and humic acid fertilizers on the weight of 1000 grains (g)

Table No. (2) Shows a significant effect of potassium addition to the plant. We note that level K2 had the highest average 1000-grain weight achieved at 43.97 grams per bowl, while K1 addition was achieved and the lowest average 1000-grain weight was 41.06 grams. This may be because the amount of 250 kg ha-1 increased the overall growth rate of the crop and the relative growth rate, resulting in an excellent increase in dry weight during the vegetative growth period. The grains (Ali Hassan et al., 2015) or due to the low number of grains in the spike led to less competition in grain weight, and this result is in agreement with (Kandel et al. 2016). We also note from the same table that there is a significant effect on the weight of 1000 grains when humic acid is added, as the achieved mixed addition treatment (HFT) (the highest mean in the 1000 grain weight trait was 49.06 g for the pot that is not significantly different from the addition treatment). Ground (HT) This indicates the positive role of the addition of the comparator acid and the benefit of the different addition methods, while the achieved treatment (H0) lower average weight 1000 grains 33.00 g per bowl and these results were identical with the findings of (Nawar et al, 2009) It indicated that there was a significant effect of the weight of a thousand grains when adding humic acid from saline water on the weight of 1000 grains, where the addition of S1 achieved the highest average 47.21 g per bowl with the level S3 achieving the lowest average 38.00 g per bowl, and this superiority in fresh water r may be due to the positive role in stimulating the plant to perform its functions in these conditions.We also note that the binary interaction between potassium and humic acid was significant, achieving the level of K2HT synthesis.The highest average weight of 1000 grains trait was 51.11 grams per container which does not differ significantly higher than the K1HFT mixture, reaching 49.67 m Evidence for the benefit of potassium levels in the case of humic addition while combination K1H0 achieved the lowest average weight of 1000 grains was 31.33 grams per pot and this is due to the fact that humic acid has an indirect effect on the natural, chemical and biological properties of the soil. It has a role in stabilizing soil assemblies, as it is responsible for about 0.3% of the cation exchange capacity of the soil, in addition to its effect on soil acidity and its regulatory capacity. We also note from the table that the binary interaction was significant between saline and humic acid addition, with the S1HFT group achieving the highest average recipe weight of 1000 tablets by 55.83g of bed pan which is significantly different from the S1HT group with the lowest S3H0 combination achieving the lowest average. 30.33g bowl-1. This may be due to the fact that organic acids contributed to an increase in biological activity within the root zone and the presence of some beneficial and activating microbes for vital processes, as well as being natural improvers that play an important and effective role in improving the natural properties of the soil. . We also note from the table that there is no significant effect of the binary interaction between potassium and saline on the 1000-grain weight, as the combination S1K2 achieved the highest average for the 1000-grain recipe was 49.58g, while the combination S1K2 achieved. 1 average not less than 37 g. pot -1. The table shows a significant triple effect between potassium, humic acid and saline water on the weight of 1000 grains, as the achieved combination S1K2HT had the highest average weight of 1000 grains 61.00 g, meaning that there was an increase of 63% compared to the combination of using fresh water and the same level of potassium In addition, without adding humic acid (S1K2H0), the reason is due to potassium, which is of great importance for grain weight and in the formation of starch, sugars and proteins, storage and transportation, which is reflected in the increase in grain weight (Abu Dahi and Younis, 1988), as well as the limited number of granular spikes, which An increase in grain weight was allowed due to the lack of competition within one tooth (Al-Azzawi, 2018). In addition to the role of acid addition in the mixture S3K2HFT, it caused an increase in the weight of 1000 grains by 30% compared to the fresh water mixture in the absence of humic acid (S1K1H0)

Table 2: Effect of salinity levels of irrigation water, potassium fertilizers and humic acid on the weight of 1000 grains-g.

SXK	Humic acid				potassium	irrigation water salinity
	HFT	HF	HT	H_0		
44.83	55.67	42.00	48.00	33.67	K_1	S_1
49.58	56.00	44.00	61.00	37.33	K_2	
41.33	49.67	37.67	47.00	31.00	K_1	S_2
43.33	47.67	42.00	48.33	35.33	K_2	
37	43.67	33.00	42.00	29.33	K_1	S_3
39	41.67	39.00	44.00	31.33	K_2	

N	LSD_{S*K}	4.388				LSD_{S*K*H}
		49.06	39.61	48.39	33.00	Humic acid averages
		1.791				LSD_H
S * H						
salinity averages		HFT	HF	HT	H_0	irrigation water salinity
47.21		55.83	43.00	54.50	35.50	S_1
42.33		48.67	39.83	47.67	33.17	S_2
38.00		42.67	36.00	43.00	30.33	S_3
1.551	LSD_S	3.103				LSD_{S*H}
K * H						
Potassium averages		HFT	HF	HT	H_0	potassium
41.06		49.67	37.56	45.67	31.33	K_1
43.97		48.44	41.67	51.11	34.67	K_2
1.267	LSD_K	2.533				LSD_{K*H}

The number of spikes in pots

Table No. (3) Shows a significant effect of potassium addition, as we note that the potassium K2 treatment achieved the highest mean of the average number of protrusions in the container and its value was 18.78 protrusions in container-1, while the addition of K1 achieved. The lowest mean number of spikes was 18.00 for bowl-1, and we also note that there was a significant effect of humic acid addition, as the addition treatment achieved by spraying (HT higher the average number of spikes (19.83). Less competition for food, and more The number of grains and the number of spikes, and this result was agreed by Kandland et al (2016) who indicated that the number of grains in the spike in wheat crop increases with the increase in concentration. 20.92 spike.bowl-1 while saline water treatment S3 achieved the lowest average for the number of spikes characteristic, where the level of decrease that occurred for this trait was 22% compared to the characteristic for the number of spikes for each pot of equivalent fresh water (S1).It is noted from the table that the binary interaction between Potassium and humic acid is not important, as synthesis is achieved.K2HT highest mean spikes of 20.11 h.p.-1 while the synthesis achieves a minimum mean number of spikes for K1H0 of 15.11 h.p.-1, while the binary reaction was considered between salinity m Yah irrigation and humic acid significantly interacted, with the combination achieving S1 HFT. The highest mean number of spurs was 23.67 years. Bowl-1, while the brine mixture was achieved without the addition of S3 H0 acid and the lowest mean spike number was 15.00 auricles. Pot-1 the role of humic acid spray in the combination S3HF is explained in the values of the number of nails per bowl, there were no significant differences for the combination of fresh water use in the absence of acid addition (S1H0), there is little interaction between potassium and salt water, where the combination S1K2 achieved the highest average The number of spikes was 21.58 spikes. $bowl^{-1}$ while the

S3K1 synthesis achieved the fewest mean spikes, with an average of 16 spikes. Pot-1, we note that the triple interaction between potassium and humic acid salinity for irrigation water is not significant for the number of spikes within one pot, and the combination S1K2 HT gave the highest average number of spikes that reached 33.24 spikes, while I recorded the S2 AndS3 treatment with the lowest mean number of spikes The spikes were 15.00 and 13.67, respectively, for both treatments, which do not represent the addition of acid in the first level of potassium fertilizer (K1).

S X K		Humic acid				potassium	irrigation water salinity
		HFT	HF	HT	H_0		
20.25		24.00	19.00	21.33	16.67	K_1	S_1
21.58		23.33	21.00	24.33	17.67	K_2	
17.75		18.33	18.33	19.33	15.00	K_1	S_2
18		16.67	19.33	19.00	17.00	K_2	
16		15.00	17.33	18.00	13.67	K_1	S_3
16.75		15.67	18.00	17.00	16.33	K_2	
N	LSD_{S*K}	N				LSD_{S*K*H}	
		18.83	18.83	19.83	16.06	Humic acid averages	
		0.978				LSD_H	
S * H							
salinity averages		HFT	HF	HT	H_0	irrigation water salinity	
20.92		23.67	20.00	22.83	17.17	S_1	
17.88		17.50	18.83	19.17	16.00	S_2	
16.38		15.33	17.67	17.50	15.00	S_3	
0.847	LSD_S	1.695				LSD_{S*H}	
K * H							
Potassium averages		HFT	HF	HT	H_0	potassium	
18.00		19.11	18.22	19.56	15.11	K_1	
18.78		18.56	19.44	20.11	17.00	K_2	
0.692	LSD_K	N				LSD_{K*H}	

Table 3: Effect of salinity levels of irrigation water and potassium and humic acid fertilizers on the number of ears per pot

Grain weight gram bowl-1 gram:

Table (4) shows that there is a significant effect of potassium addition levels on the total weight of the grains, as we note that the addition of K2 level achieved the highest rate in the total weight of the grains by 55.61 g pot-1 compared to adding K1 (47.17 g pots) we also note that there is a significant effect when Addition of humic acid to the total grain weight, the achieved addition H was the highest characteristic average gross grain weight with an average capacity of 56.89 g. Pots-1, which represented a 43% increase over the treatment without addition of humic acid (H0), which represented the lowest mean grain weight in the pot, and there were no significant differences in the methods of acid addition. Where the mixed addition amounted to 54.89 g. Pot 1, and we note a significant effect of saline water levels on the total weight of the grains, as treatment S1 gave the highest characteristic of the average total seed weight with an average of 61.79 grams. S1 this large difference is due to the increase in the concentration of salts in the soil which reduces the size and weight of the grains and thus reduces the weight of the grains. Grains, which indicates the role of the appropriate level to add potassium fertilizer and add humic acid by spraying the vegetative part of it. This positive effect was reflected by the use of fresh water (S1) for crop irrigation, which outperformed the levels of saline (S3) when irrigating, as the pressure of the zygomatic cells of plants reduces potassium to sodium and works to make the center unbalanced in the upper leaves and works to prevent The enzymatic processes gave the K2HT combination the highest average characteristics for the total weight of the grains at a rate of 63.00 g from container^{-1}, which is not significantly different from the mixture K2HFT, while the 0 K1H combination gave the lowest average characteristic for the total weight of the grains at an average of 43.78 g in container^{-1}. This indicates that The role of adding land to acid in raising the level of potassium availability at the level of K2 which led to the readiness of these results agreed with Hashem (2018), who indicated that the increase in the number of fertility mutations increases with the increase of humic acid, and it was noted that there is a significant duality. Saline and humic acid, as the studied combination S1HT had the highest average of traits for a total seed weight of 68.83 g pot^{-1}, while the two obtained from S3H0 fiber had the lowest average total seed weight (39.67). gm pot^{-1}) This indicates the role of irrigation with fresh water (S1) in taking advantage of the land’s addition of humic acid to increase the grain yield (Hashem, 2018). We also note that there is a significant binary interaction between potassium levels and salinity of the irrigation water, as we note that the K2S1 formulation achieved the highest average total grain weight of 65.17 g pot^{-1} while it achieved the lowest average total grain weight in the group. S3K1 (37.58 g pot^{-1}) It is also noted that there are no significant differences between the S3K2 mixture and the S2K1 mixture, meaning that S3 brine can be used while ensuring that a K2 level of potassium is added. This may be due to the accumulation of salts in the root propagation zone and thus reducing the ready content of nutrients as a result of competition between ions and between salts (Saleh et al., 2012)We also note from the same table that the triple interaction between potassium, salinity of irrigation water and humic acid was not significant, and the combination S1K1H T achieved the highest average for the characteristics of the total weight of the seeds 73.67 g pot^{-1}, while the combination S1K1H T achieved the lowest mean for the characteristics of the total weight per seed and it is 35.33 g pot^{-1}.

Table (4): Effect of salinity levels of irrigation water, potassium fertilizers and humic acid on the weight of grains kept in a pot.

S X K	Humic acid				potassium	irrigation water salinity
	HFT	HF	HT	H_0		

58.42	64.33	51.33	64.00	54.00	K_1	S_1
65.17	72.33	57.67	73.67	57.00	K_2	
45.5	47.00	45.00	49.00	41.00	K_1	S_2
57.25	64.33	47.00	68.00	49.67	K_2	
37.58	35.33	39.33	39.33	36.33	K_1	S_3
44.42	46.00	41.33	47.33	43.00	K_2	
2.90 LSD_{S*K}	N				LSD_{S*K*H}	
	54.89	46.94	56.89	46.83	Humic acid averages	
	2.37				LSD_H	
S * H						
salinity averages	HFT	HF	HT	H_0	irrigation water salinity	
61.79	68.33	54.50	68.83	55.50	S_1	
51.37	55.67	46.00	58.50	45.33	S_2	
41.00	40.67	40.33	43.33	39.67	S_3	
2.05 LSD_S	4.10				LSD_{S*H}	
K * H						
Potassium averages	HFT	HF	HT	H_0	potassium	
47.17	48.89	45.22	50.78	43.78	K_1	
55.61	60.89	48.67	63.00	49.89	K_2	
1.67 LSD_K	3.35				LSD_{K*H}	

References

1. Al-Jilani, Abdul-Jawad, Abdul-Rahman Ghayba and FadelQaddouri (1997). Uses of semi-saline and saline water in irrigation. Deliberations of a workshop held in Cairo on the uses of semi-saline and saline water in Arab agriculture and the preparation of a guide on the quality of water used for irrigation in the Arab world.
2. Zubaidi Ahmed Haider. 1989. Soil salinity. Theoretical and applied foundations, University of Baghdad - Dar Al-Hekma
3. Hashem and Muhammad Alwan. 2018. Effect of humic acid and potassium on growth and yield of soft wheat. L aestivumTriticum. DhiQar University Journal of Agricultural Research, Volume 7 (1)

4. Purbia c. s. , (2005). The effect of salinity on the phenomenon of light radiation. Faculty of Nature and Life Sciences Mentouri University of Constantine.
5. Al Ghurairi, Saad Mahdi Muhammad. 2011. Reducing the adverse effect of salt stress on wheat growth and yield by using foliar fertilization. PhD thesis - College of Agriculture - University of Baghdad. Al-Azzawi, Hussain Khudair Abbas, Mohsen Ali Ahmad Al-Janabi, the Trap of Eral-Din Abdul-QadirSiddiq. 2018. Effect of different levels of nitrogen fertilizers on grain yield and its components for eight types of soft wheat. Triticumaestivm L. Journal of Tikrit University for Agricultural Sciences Issue 18 Issue 1.
6. Al-Fahdawi, Rowaida Salam, Friday, Thursday, 2017. Effect of spraying with humic acid on growth characteristics and yield of some barley (Hordeumvulgare L) cultivars. master of this. Field Crops Division. College of Agriculture - University of Anbar.
7. BaqerHaider Abdel Razek 2015. Response of wheat bread-6 sham to added potassium
8. Abdullah, Moaz Abdul-Wahhab Al-Fahd 2010) The effect of chemical and organic fertilization on some growth characteristics, yield and active substances of the anise plant Pimpinellaanisum L. in gypsum soil. Tikrit University Journal of Agricultural Sciences.
9. Abdel-KhaleqAsalaManaf 2017. Effect of nitrogen levels and iron spraying on growth and productivity of wheat.
10. Abu Dahi, Yusef, SadiqKazemTaban. 5002. Effect of potassium addition to soil and spraying on straw yield, wheat grain and NPK concentration. Iraqi Journal of Agricultural Sciences. (60-56, 63) 5.
11. Al-Hasnawi, Asmaa Malik Abdel-Abbas. 2016. Effect of nitrogen fertilizer levels, distances between planting lines and seed quantities on growth and yield of oats (Avena sativa L). Master's thesis, College of Agriculture - University of Al-Muthanna.
12. Hashem and Muhammad Alwan. 2018. Effect of humic acid and potassium on growth and yield of soft wheat. L aestivumTriticum. DhiQar University Journal of Agricultural Research, Volume 7 (1)
13. Al-Yasiri and Mahmoud Nasser Hussein. 2012. Effect of batches and levels of nitrogen and potassium fertilizers on the availability and release of ammonium and potassium in the soil and on the growth of wheat crop. master of this. College of Agriculture - University of Baghdad.
14. Yassin, Musa Fetikhan, Omar Karim Obaid and Mustafa Jaber Ali. 2014. Effect of the interaction between phosphate gypsum, soil texture and salinity type on some chemical properties of soil after bilateral washing. Tikrit University Journal of Agricultural Sciences. Volume 14 (1)
15. Saadi, Iman Sahib Salman. 2007. Evaluation of the status and behavior of potassium added from two sources of fertilizer under different irrigation systems in the growth and yield of tomatoes and maize. PhD theses. Faculty of Agriculture. Baghdad University
16. Al-Zubaidi, Ahmed Haider Al-Zubaidi, 4080, Soil salinity and theoretical and applied foundations, Ministry of Higher Education and Scientific Research, University of Baghdad - House of Wisdom.
17. Ali, NoureddineShawqi, Hamdallah Suleiman Rahi and Abdel Wahhab Abdel Razzaq Shaker. 2014. Soil Fertility. Ministry of Higher Education and Scientific Research. Scientific Books House for printing, publishing and distribution.
18. Shalash, JumaSanad, Ali Ammar Ismail, Abdel-Sattar Karim Ghazi, 2011. Response of olive seedlings to foliar feeding with hemogreen, iron vinegar and zinc. Journal of Agricultural Sciences. 43 (1): 58–75. Nutrient readiness and maize yield, Ph.D. thesis. Faculty of Agriculture. Baghdad University
19. Mashhadni, M. Al-Hadithi, A.K. 2017. Effect on humic acid on some soil properties and squash growth irrigated with different saline water. Gorhal Inks for Agricultural Sciences. 15 (2)
20. Reform AD, Al-Hafni. (2010). Effect of irrigation water and humic acid use on growth and yield of two cobia cultivars (vighauhguiciata L. walp). Australian Joomal for Basic and Applied Sciences. 4, 12: 6154-6168.
21. Rezaeian S. Evaluation of diosgenin production by Trigonellafoenum - graecum L. in an in vitro condition. I J Planet Physiol. 2014; 6 (5): 261–268. 7 (2): 182-186.

22. Monthly, t. And Ibrahim Malas - usuallyFor example 2011. Increasing wheat grain yield using environmental biology. 5: 516-518.
23. Fig, A.J. web. Stomped. 1977. Potash improves the growth and yield of wheat. Potash Rev, 9 (39), 5.
24. Akhtar, M.; s. Ahmad; Mohsen W. Mahmood. 1999. Interactive effect of phosphorous and potassium nutrition on the growth and yield of a hybrid (zea mays L.). Pakistan Journal of Biological Sciences, 2 (1), 240-241.
25. Kulikova, N. A., Dashitsyrenova, A. D., Perminova, I. V. and Lebedeva GF2003. Auxin-like activity of different parts of coal humic acids, Bulgarian J. Ecolog.Sci. 2 (3-4), 55-56.
26. Jean and Boyd (2000) carry vegetable crops to salinity. World. Hortjournal of Agriculture and Biology, 6: 458-461.
27. A. H. Jabbar, S. O. Mezan, A. N. Tuama, M. Q. Hamzah, A. S. B. Ameruddin, and M. A. Agam, ‘‘Enhanced bioactivity of polystyrene-silver nanocomposite (PS/Ag NCs)-an antimicrobial study,” 2019, doi: 10.1063/1.5124632.
28. Anwar, Q, Iqbal, F, Khattak, Washington, Babar, Michigan and Shahryar Khan. 2016. Response of the wheat crop to humic acid and nitrogen levels.
29. Saleh, H.M., Ali, N. Salman, ES 2012. Effect of foliar potassium supplementation on maize yield in Iraqi soil. Tikrit University. For Agri. Sci PP 5 (3): 245-259
30. Qandil A. Sheriff AEM1; Seadh SE1 and Altai DS K2. 2016. The Role of Humic Acid and Amino Acids in Reducing Loss of Nitrogenous Fertilizers and Increased Productivity of Some Wheat Varieties Cultivated Under Newly Reclaimed Sandy Soil. International Journal of Advanced Research in Biological Sciences. Volume 3, Version 4 - 2016.