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IMPACT OF POTASSIUM HUMIC ACID ON GROWTH AND YIELD COMPONENTS OF SOME BREAD WHEAT (*TRITICUM AESTIVUM* L.) GENOTYPES

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Abstract

Humic acid (HA), contains organic matter that accumulates in ecological systems, increase plant growth by buffering pH and chelating unavailable nutrients. in this study, We examined the effect of HA added by spray with three doses on heading date, yield and its component of five wheat varieties (*Triticum aestivum* L.) grown in split-plot design in Iraq. Almost traits of wheat under study, were significantly increased by increasing humic acid rates, The desirable mean values of heading date (99 day)was obtained when the variety Adna 99 received 200 g/ 100 liter. The heaviest 1000-kernel weight (44.77 g)was obtained when the variety bhoth22 received 300 g/ 100 liter and the variety Rashed received 250 g/ 100 liter. The highest mean value of no. of spike/ plant (45.99) was obtained when the variety Adna 99 received 250 g/ 100 liter. The highest mean value of no. of grain/ spike (57.45) was obtained when the variety both 22 received 250 g/ 100 liter. The highest mean value of no. of spikelet/ spike (26.27) was obtained when the variety bhoth22 received 300 g/ 100 liter. The highest mean value of plant height (116.33) was obtained when the variety sham 6 received 200 g/ 100 liter. As for grain yield/ plant the treatment 300g humic/ 100 liter when added to Adna 99 showed the highest values. Regarding biological yield/ plant the highest treatment was obtained in the combination between the variety Rashed and 300g humic/ 100liter.
Keywords: Wheat (*Triticum aestivum* L.); Humic Acid; Day to 50% heading; Yield and yield components

Introduction

To manage agriculture production in unfavorable soil conditions by enriching their organic matter, various options are found in literature, for example, crop rotation, green manures, residue or animal manures incorporation, tec. and humic acid application (Sharif *et al*., 2002). All these options basically aim at improving soil conditions for growth and quality of crop.

Agricultural specialists have recently resorted to the use of liquid organic fertilizers as a substitute for mineral fertilizers that improve plant strength and to obtain later on the highest crop and free from pollution and to reduce the residual effect of nitrates and nitrites in crops especially when using nitrogen fertilization, humic acid (polymer hydroxy acid) is one of the most important Organic fertilizers in this field, which is one of the organic acids that are produced naturally and from the humic substance compounds resulting from the decomposition of the organic matter. It contains in its composition carbon, hydrogen, nitrogen and oxygen in varying proportions resulting in the formation of a compound with molecular weights varying (Khan *et al*., 2010).

The addition of humic acid to the soil leads to increased absorption of nutrients by the plant as it acts as a medium for transporting nutrients from the soil to the plant especially in the event of drought (Asal *et al*., 2015), as it increases the strength of the root group growth and improves it by increasing dry and wet weight and increasing lateral branching of the roots, It increases the plant's protein content and increases the number of beneficial microorganisms in the soil (Cimrin and Yilmaz, 2005). It also breaks down heavy soil granules and improves their physical, chemical, and biological properties by destroying clay particles and increases the soil's ability to retain water, which is safe and highly soluble. In the water, it is easy to add it with quick effectiveness and does not leave any harmful effects on humans and plants, as it increases the development of chlorophyll and the collection of sugars, amino acids and enzymes and helps in photosynthesis, and its role is similar to the role of oxen in cell division, which encourages plant growth, and humic acids reduce. One of the problems of excess salinity, which causes toxicity to the plant and thus burning the roots resulting from this increase. Humates stimulate micro-organisms and therefore are conducive to humus restoration.

Although yield potential of wheat increasing because of produce a new varieties with high yield to meet the needs of an increasing global demand. Thus, there is a need to increase wheat new varieties productivity worldwide. In order to further increase wheat yield potential genetically, it is important for us to understand the physiological and genetic basis of yield.

Grain yield in wheat can be analyzed in terms of three yield components (number of spikes per square meter, number of kernels per spike, and kernel weight) that appear sequentially with later developing components under control of earlier developing ones. The objectives of the present study were to investigate the influence of humic acid application and varieties on yield and yield components of wheat.

Materials and Methods

The field trial was conducted at Agricultural Extension and Training Department, Mandali City, Iraq, during growing seasons of 2018/2019 to study the effect of humic acid and varieties on grain yield and yield components of wheat. Soil samples at (0-30 cm depth) were taken from the experimental site before planting for physical and chemical analysis (Table1). This study was performed at Mandali City, Iraq

Three humic acid (HA) treatments (200g, 250g and 300g/ 100 liter). Five bread wheat genotypes (sham 6 , Rashed, Adna 99, Tamoiz and Bhoth22) were used in this study as plant materials.

Table 1 : Mechanical and chemical analysis at the field of the experiment

Soil characters	Mechanical analysis	Soil characters	Chemical analysis
Course sand%	24.1	PH	7.2
Fine sand	12	EC	3.14 ds m^{-1}
Silt%	21.5	OM%	2.90%
Clay%	42.4	Available K ppm	199
Soil texture	clay	available eq/l	1.5

The experiment procedure

The experiment was laid out in split split plot design with three replicates. The three spraying humic treatment 2000, 2500 and 3000 ppm at 21 days after planting. The five wheat genotypes were assigned to sub plot. Yield and yield components were recorded. Measured characters were days to heading , 1000 kernel weight, No of grain/ spike, No of spikelet's/ spike, Plant height, grain yield/ plant, harvest index.

Results and Discussion

Humic treatments and varieties as well as interaction is shown in Table 3. potassium humate, variety and interaction between them had significantly effect on all studied traits at probability level of 1 %.

Table 2 : Mean squares of wheat genotypes at presence of potassium humate for all studied traits.

	Day to 50% heading	1000-kernel weight	No of spike/ plant	No of grain/ spike	No of spikelet's/ spike	plant height	grain yield/ plant	biological yield/ plant	Harvest index
Replication	7.93	2.79	4.48	8.73	2.483	40.24*	24.59*	31.71	7.93
Humic treatment (H)	70.02**	58.61**	162.15**	49.17**	16.02**	171.01**	492.88**	1282.55**	70.02**
Error a	1.54	0.54	3.082	2.512	0.141	7.98	5.37	24.51	1.54
Variety (V)	198.64**	76.36**	51.76**	54.32**	9.28**	91.19**	65.98**	931.61**	198.64**
HxV	277.03**	47.31**	197.19**	60.51**	4.45**	107.38**	109.09**	2241.27**	277.03**
Error b	5.43	0.73	1.23	5.00	0.72	5.43	9.69	24.12	5.43

* and ** indicate $p < 0.05$ and $p < 0.01$, respectively.

Effect of humic acid treatments

Results in table 3 show the effect of humic acid treatment on the studied traits of wheat. Humic treatments were significantly with increase the level of humic, there were increased in all studied traits. The increase in the growth and yield traits of wheat was most probably due to the improvement of soil condition of the root zone, and providing nutrients and the effective role of potassium. Potassium has many different roles in plants: In Photosynthesis, potassium regulates the opening and closing of stomata, and therefore regulates CO_2 uptake. Potassium triggers activation of enzymes and is essential for production of Adenosine Triphosphate (ATP). ATP is an important energy source for many chemical processes taking place in plant issues. Potassium plays a major role in the regulation of water in plants (osmo-regulation). Both uptake of water through plant roots and its loss through the stomata are affected by potassium. Known to improve drought resistance. Protein and starch synthesis in plants require potassium as well. Potassium is essential at almost every step of the protein synthesis. In starch synthesis, the enzyme responsible for the process is activated by potassium Mackowiak *et al.* (2001), Jones *et al.* (2007) and Tahir *et al.* (2011).Activation of enzymes – potassium has an important role in the activation of many growth related enzymes in plants.

Effect of wheat varieties

Results presented in Tables 3 showed that mean values of all growth traits, yield components, and yield s were significant differences with the studied five wheat varieties, *i.e.* Sham 6, Rashed, Adna 99, Tamoiz and Bhoth 22.

The maximum mean values of No of spike/ plant was detected by the variety Rashed (33.41). The desirable values for mean values of heading date and 1000-kernel weight were obtained by the variety Adna 99 (99.89 day and 42.56g, respectively). Planting wheat variety Tamoiz increased no of spikelets/ spike and grain yield/ plant they scored 25.82 and 54.67, respectively. Results may reveal the superiority of Bhoth22 in mean values of No of grain/ spike (52.17), grain yield/ plant (54.74) and harvest index (45.56).

These differences may be due to the genetic differences between the five wheat varieties. Also, the differences in 100-kernel weight might be attributed to the variation in translocation rate of photosynthetic from leaves to the storing organs, *i.e.* the kernels. These results are in harmony with those reported by Mackowiak *et al.* (2001), Jones *et al.* (2007) and Tahir *et al.* (2011) showed that hybrids markedly varied for almost growth, yield, yield components and kernels of wheat.

Interaction effect

Results in Tables 3 showed that significant effect of the interaction between humic rates and wheat varieties obtained for almost growth, yield, and yield.

varieties which fertilized by the high humic rate (300 g/100 liter h/plot) recorded significantly the highest mean values of heading date (101.4 day), 1000-kernel weight (40.58 g), No. of spike/ plant (34.15 kernels), No. of grain/ spike (49.85 g), no of spikelet's/ spike (25.57), plant height (112.51 cm) ,grain yield/ plant (56.31g) and biological yield/ plant (145.04).

The desirable mean values of heading date (99 day) was obtained when the variety Adna 99 received 200 g/ 100 liter. The heaviest 1000-kernel weight (44.77 g)was obtained when the variety bhoth 22 received 300 g/100 liter and the variety Rashed received 250 g/ 100liter. The highest mean value of no. of spike/ plant (45.99) was obtained when the variety Adna 99 received 250 g/100 liter. The highest mean value of no. of grain/spike (57.45) was obtained when the variety bhoth22 received 250 g/ 100 liter. The highest mean value of no. of spikelet's/ spike (26.27) was obtained when the variety bhoth22 received 300 g/ 100 liter. The highest mean value of plant height (116.33) was obtained when the variety sham 6 received 200 g/ 100 liter. As for grain yield/ plant the treatment 300g humic/ 100 liter when added to Adna 99 showed the highest values. Regarding biological yield/ plant the highest treatment was obtained in the combination between the variety Rashed and 300g humic/ 100liter.

These results are in agreement with those obtained by Mackowiak *et al.* (2001), Jones *et al.* (2007) and Tahir *et al.* (2011) they found that growth, yield components, and yield of wheat were significantly affected by the interaction between humic rates and wheat varieties.

Table 3 : Mean comparison of the effect of humic and varieties as well as the interactions between them for all studied traits.

	Day to 50% heading				**1000-kernel weight**				**No of spike/ plant**			**mean**
	200 g/ 100 liter	**250g/ 100 liter**	**300g/ 100 liter**	**mean**	**200 g/ 100 liter**	**250g/ 100 liter**	**300g/ 100 liter**	**mean**	**200 g/ 100 liter**	**250g/ 100 liter**	**300g/ 100 liter**	**mean**
sham 6	101.33	100	102	101.11	33.4	33.13	43.6	36.71	36.66	31.89	29.77	32.77
Rashed	100	100.33	102	100.78	33.7	44.77	39.57	39.34	30.46	33.66	36.11	33.41
Adna 99	99	100.33	100.33	99.89	42.5	43.6	41.57	42.56	24.11	45.99	27.77	32.63
Tamoiz	100.67	102.33	101.33	101.44	36.03	39.57	33.43	36.34	24.77	24.22	34.44	27.81
Bhoth22	100.67	100	101.33	100.67	40.03	41.57	44.77	42.12	22.44	24.11	42.66	29.74
Mean	100.33	100.6	101.4		37.133	40.53	40.58		27.69	31.98	34.15	
	No of grain/ spike				**No of spikelet's/ spike**				**plant height**			
	200 g/ 100 liter	**250g/ 100 liter**	**300g/ 100 liter**	**mean**	**200 g/ 100 liter**	**250g/ 100 liter**	**300g/ 100 liter**	**mean**	**200 g/ 100 liter**	**250g/ 100 liter**	**300g/ 100 liter**	**mean**
sham 6	43	45.69	48.2	45.62	23.6	25.4	25.53	24.84	116.33	103.22	116.89	112.15
Rashed	50.45	42.89	52.2	48.51	22.8	23.27	25.07	23.71	102.55	107.11	116	108.55
Adna 99	40.32	47.34	53.34	47	22.13	24.87	22.93	23.31	103.55	106.89	112.33	107.59
Tamoiz	47.1	49.12	46.89	47.7	25.6	23.8	28.07	25.82	102.11	116.22	114.22	110.85
Bhoth22	50.44	57.45	48.61	52.17	23.4	25.27	26.27	24.98	108.22	100.44	103.11	103.92
Mean	46.26	48.49	49.85		23.51	24.52	25.57		106.55	106.78	112.51	
	grain yield/ plant				**biological yield/ plant**				**Harvest index**			**mean**
	200 g/ 100 liter	**250g/ 100 liter**	**300g/ 100 liter**	**mean**	**200 g/ 100 liter**	**250g/ 100 liter**	**300g/ 100 liter**	**mean**	**200 g/ 100 liter**	**250g/ 100 liter**	**300g/ 100 liter**	**mean**
sham 6	48.59	48.48	55.18	50.75	158.62	119.76	164.87	147.75	30.62	40.52	33.45	34.86
Rashed	37.79	55.18	52.77	48.57	101.31	153.3	173.62	142.74	37.3	35.99	30.43	34.58
Adna 99	37.82	52.77	61.77	50.78	145.41	152.07	102.14	133.21	26.02	34.75	60.47	40.41
Tamoiz	50.53	61.77	51.71	54.67	120.16	138.73	134.5	131.13	42.05	44.67	38.45	41.72
Bhoth22	52.39	51.71	60.11	54.74	107.64	107.75	150.05	121.82	48.68	47.96	40.05	45.56
Mean	45.42	53.98	56.31		126.63	134.32	145.04		36.94	40.78	40.57	

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