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Impact of Humic Acid and Nitrogen Fertilization on Productivity of some Bread Wheat Cultivars

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Abstract

A field experiment was carried out at the Agronomy Experimental Farm, Faculty of Agriculture, Assiut Univ., during 2017/2018 and 2018/2019 seasons, to investigate the impact of humic acid and nitrogen fertilization on productivity of some bread wheat cultivars. Experimental design was randomized complete block design (RCBD) using strips plot arrangement with three replications, where the three humic acid [0 (control), humic acid 2 g/L. and humic acid 4 g/L. i.e. H_0, H_1 and H_2)] were assigned horizontally; three nitrogen fertilization rates (50, 75 and 100 kg N/fed. i.e. N_1, N_2 and N_3) were allocated main vertically and three wheat cultivars (Sids 12, Gemmeza 11 and Misr 1 i.e. Cv_1, Cv_2 and Cv_3) were allocated in the sub-plots.

The results could be summarized as the following:

- Humic acid 4 g/L treatment recorded the tallest plants, the longest spikes, the heaviest 1000 grain and the maximum grain yield/fed. in the both season, as well as the highest grain weight/spike in the 1st season and the highest number of spikes/m^2 in the 2nd season.
- The most studied traits were increased with increasing N fertilizer rate up 100 kg N/fed., as well as the highest grain weight/spike was obtained by 75 kg N/fed. in the both seasons.
- Gemmeza 11 cultivar surpassed the Sids 12 and Misr 1 cultivars and gained the highest mean values for spike length, 1000 grain weight and grain yield/fed. in the both seasons and the highest grain weight/spike in the 2nd season, while Misr 1 cultivar gave the tallest plants and the greatest number of spikes/m^2 in the both seasons.
- The H_2xN_3 (humic acid 4 g/L x 100 kg N/fed.) interaction treatment gave the maximum 1000 grain weight and grain yield/fed., as well as the tallest plants and the longest spikes in the both seasons. Moreover, the highest mean values for plant height, number of spikes/m^2 and grain yield in the both season were obtained by H_2xCv_3 (humic acid 4 g/L x Misr 1) interaction and N_3xCv_3 (100 kg N/fed. x Misr 1) interaction in the both seasons.
- The highest mean values for spike length, 1000 grain weight and grain yield/fed. in both seasons, as well as grain weight/spike in the 2nd season were achieved by $H_2xN_3xCv_2$ (humic acid 4 g/L x 100 kg N/fed. x Gemmeza 11 cultivar) interaction treatment as well as the tallest plants were achieved by $H_2xN_3xCv_3$ (humic acid x 100 kg N/fed. x Misr 1 cultivar) interaction treatment in both seasons.

Keywords: *wheat cultivar, N fertilizer, humic acid and interaction treatments.*

Introduction

Wheat (*Triticum aestivum* L.) is an important cereal and food crop in Egypt and all over the world. There is need to increase wheat production world wide, in particular in developing countries.

Increasing population and limited agricultural lands has led efforts to continue in increasing the yield per unit area by different ways, including advanced farming operations and selecting resistant and productive genotype. Humic materials are one of the important components of the soil, which affected its chemical and physical properties and improve its fertility (Molasadeghi and Shahryari, 2011).

Humic acid has been reported as a promising resource showing persistent effects on plant growth promotion, nutrient uptake and improving soil nutrient status by increasing organic matter (9%), total N (30%), available P(166%) and available K (52%) indicating a substantial increase in soil nutrient status (Arjumend *et al*., 2015). However, Bakry *et al*. (2016) showed that humic acid foliar spray significantly surpassed without spray (control in all studied characters i.e. plant height, spike length, grain yield/spike, grain index, number of spikes/m^2 and grain yield/fed.). Manal *et al*. (2016) declared that the highest mean values of spike length, grains weight/spike, 1000 grain weight and grain yield/fed. were obtained of wheat by foliar spray with 2 litters of humic acid/fed. over both seasons. Khan *et al*. (2018) denoted that spike weight and grain yield/fed. were increased by 19% and 21% over control with application of plant drived humic acid at the rate of 50 mg/kg soil, respectively. Merwad (2019) indicated that humic materials increased plant height and yield parameters i.e. 1000 grain weight and grain yield of wheat.

Fertilizers are rich sources of plant nutrient required for increasing crop production. It is essential to know the best level of fertilization application for getting a higher crop yield, so that the maximum benefits could be achieved. Nitrogen is one of major macronutrients that is the most important treatment to increase grain and straw yields in wheat cultivars. Mansour *et al.* (2016) mentioned that application of 125 kg N/fed. achieved the maximum spikes number/m^2, 1000 kernel weight and total yield/fed. in both seasons. Rekaby *et al*. (2016) concluded that the highest significant mean values of plant height, spikes number/m^2, grains weight/spike and grain yield/fed. of wheat were recorded by 240 kg N/ha in both seasons. El-Hag and Shahein (2017) pointed out that increases in nitrogen fertilizer significantly increased plant height, spikes number/m^2 and grain yield/fed., while decreased 1000 grain weight during both seasons. Haque *et al*. (2017) noted that application of 180 kg N/ha resulted in the highest spike length, 1000 grain weight and grain yield/fed. Farooq *et al*. (2018) confirmed that application of 150 kg N/ha resulted in the maximum mean values for plant height, spike length, 1000 grain weight and grain yield/ha.

Different new varieties were released. These varieties need some information about agricultural practices to reach the potentiality of each variety, as well as increasing wheat yield per unit area can be achieved by introducing high yielding varieties. Hussain *et al*. (2006) found that Daman-98 cultivar had maximum plant height, grain weight/spike, 1000 grain weight and grain yield, while Dera-98 cultivar had the maximum spikes number/m^2. Hassanien *et al*. (2013) stated that Sakha-69 cultivar exceeded Sids-1 in plant height, number of spikes/m^2 and grain yield/fed. Fergani *et al*. (2014) highlighted that Gemmiza 9 cultivar gave the highest significant number of spikes/m^2, spike length, grains weight/spike and grain yield in comparison to Sakha-93 and Giza 168 cultivars. Zaki *et al*. (2015) declared that Misr 2 cultivar gave higher plant height, number of spikes/m^2, grain index and grain yield/fed. than Baniswef-4 cultivar in both seasons. Mansour *et al*. (2016) stated that Misr 1 cultivar surpassed Misr-2 and Sids-12 cultivars with regard to number of spikes/m^2, 1000 grain weight and grain yield/fed. in both seasons. Solomon and Anjulo (2017) showed that Digalu variety superior with plant height, grain weight/spike and grain yield/fed., while Hidasse variety superior with 1000 grain weight. Zenhom *et al*. (2018) indicated that Gemmeza 11 cultivar gave the tallest plants, whereas Misr 2 cultivar gave the highest seed index and grain yield/fed.

The objective of this work was to evaluate the impact of humic acid and nitrogen fertilization on productivity of some bread wheat cultivars.

Materials and Methods

A field experiments was carried out at the Experimental Farm of Agronomy Dept., Assiut University, during 2017/2018 and 2018/2019 seasons to investigate the impact of humic acid and nitrogen fertilization on productivity of some bread wheat cultivars. The experiment was laid out in randomized complete block design (RCBD) using strip plot within split plot with three replicates. Three N level (50 kg/fed, 75 kg/fed., 100 kg/fed.) were assigned vertically as well as three humic acid levels (0 [control], humic 2 g/L and hjmic 4 g/L) were allocated horizontally and three bread wheat cultivars (Sids 12, Gemmeza 11 and Misr 1) were randomly distributed in the sub plot. Plot area was 10.5 m^2 (3.5 m length x 3.0 m width). The experimental soil was clay, mechanical and chemical properties of soil are shown in Table 1.

Table 1. Mechanical and chemical properties of the experimental site.

Properties	2017	2018
Mechanical analysis		
Sand	27.00	27.80
Silt	23.00	22.20
Clay	50.00	50.00
Soil type	Clay	Clay
Chemical analysis		
pH	7.63	7.85
Organic matter %	1.80	1.70
Total N %	0.09	0.08

Cultural practices:

Wheat grain were hand sown on 5th December and 26th November in the first and second seasons, respectively. Spraying of humic acids was done at 45 and 60 days after sowing as well as the control plants were sprayed by distilled water. Nitrogen fertilizer was applied in the form of urea (46% N) in three equal doses before the first, second and third irrigation, respectively. All other cultural practices as recommended for wheat crop were done in both seasons.

Characters, sampling and measurement:

At harvest, a sample of five guarded plants was taken randomly from each sub-plot in three replicates to determine the following characters: Plant height (cm); measured from soil surface to the tip of the spike excluding awns; Grain weight/spike (g); Spike length (cm); measured from the base of the spike to its tip excluding awns; Number of spikes/m^2; sample of one square meter was randomly taken from each sub-plot; 1000-grain weight (g): it was recorded from a grain sample take at random from each sub-plot and grain yield/fed.; it estimated from the harvested plot area after over drying and weighing, grains were threshed from the straw, cleaned and weighed in kilograms and converted into ardab/feddan.

Statistical analysis:

All the obtained data for each season were exposed to proper statistical analysis of variance according to Gomez and Gomez (1984) using the MSTAT-C Statistical Software Package descried by Co-Stat (2004). The least significant difference (LSD) at 5% level of probability were computed to detect the difference among means.

Results and Discussion

Main effects:

Data in Table 2 revealed that the most studied traits i.e. plant height, spike length, grain weight/spike, 1000 grain weight and grain yield/fed. were highly significant affected by humic acid in the both seasons, except number of spikes/m^2 in both seasons. Grain weight/spike in the 2nd season did not affected significantly by this trial. The highest mean values for the plant height (106.53 and 102.73 cm) and spike length (12.74 and 13.28 cm), 1000 grain weight (47.97 and 54.86 g), grain weight/spike in the 1st season and grain yield/fed. (22.24 and 23.30 ard.) in the both season were obtained by humic acid 4 g/L. The results mean that the highest humic acid concentration was the effective for achieving the maximum mean values for the most studied traits. Jaleel *et al.* (2008) suggested that humic acid promote plant growth and improved yield. These results are in agreement with those reported by Arjumend *et al.* (2015), Manal *et al.* (2016), Khan *et al.* (2018) and Merwad (2019).

Regarding to nitrogen fertilizer rates, the results in the same Table showed that the plant height and grain yield/fed. were a highly significant affected by nitrogen fertilizer rates in the both seasons, as well as spike length and 1000 grain weight exerted significantly influence by the nitrogen fertilizer rates, whilst grain weight/spike and number of spikes/m^2 did not significantly affected by this trial in both seasons. In general, the above studied traits increased by increasing N fertilizer rates and the maximum mean values were realized by either 75 kg N/fed. or 100 kg N/fed. in both seasons. It is clear from these data that N fertilizer enhanced the vegetative growth of wheat plants, increased photosynthetic activity and metabolites required to produce long spikes, increase 1000 grain weight and consequently reacted wheat yield. Similar findings were found by Rekaby *et al.* (2016), El-Hag and Shahein (2017), Haque *et al.* (2017) and Farooq *et al.* (2018).

Table 2. Main effects of humic acid (H), nitrogen fertilizer (N) and wheat cultivars (Cv) on the plant height (cm), yield components and yield (ard./fed.) in 2017/2018 and 2018/2019 seasons.

Characters / Main effect	Plant height (cm)		Spike length (cm)		Grain weight/spike (g)		Number of spikes/m^2		1000-grain weight (g)		Grain yield (ard./fed.)	
	2017/2018	2018/2019	2017/2018	2018/2019	2017/2018	2018/2019	2017/2018	2018/2019	2017/2018	2018/2019	2017/2018	2018/2019
Humic acid (H)												
H_0	92.56	93.87	11.22	11.77	2.41	3.06	306.12	265.34	41.93	48.14	18.34	19.75
H_1	99.10	99.09	12.14	12.66	2.56	2.77	317.87	307.27	45.30	51.87	20.28	21.64
H_2	106.53	102.73	12.74	13.28	2.85	2.80	308.62	327.09	47.94	54.86	22.24	23.30
F-test	**	**	**	**	*	N.S	N.S	N.S	**	**	**	**
LSD 0.05	**1.64**	**1.92**	**0.53**	**0.37**	**0.28**	--	--	--	**0.69**	**2.29**	**0.21**	**0.41**
Nitrogen fertilizer (N)												
N_1	96.11	97.13	11.70	12.18	2.56	2.78	311.36	298.07	43.80	49.31	19.46	20.88
N_2	99.34	98.87	12.09	12.61	2.69	3.07	301.46	280.21	44.62	52.82	20.40	21.56
N_3	101.74	99.70	12.31	12.92	2.58	2.77	319.79	321.42	46.75	52.74	21.02	22.26
F-test	**	**	*	*	N.S.	N.S.	N.S.	N.S.	*	*	**	**
LSD 0.05	**1.29**	**1.44**	**0.40**	**0.43**	--	--	--	--	**1.97**	**2.53**	**0.27**	**0.24**
Cultivars (Cvs)												
Cv_1	93.53	91.90	11.86	12.37	2.83	2.89	277.38	287.80	43.26	51.14	19.97	20.92
Cv_2	100.09	99.50	13.08	13.64	2.94	3.45	271.06	250.36	48.37	57.01	20.56	22.51
Cv_3	103.57	104.30	11.16	11.70	2.06	2.28	384.17	361.53	43.55	46.71	20.35	21.27
F-test	**	**	**	**	**	**	**	**	**	**	**	**
LSD 0.05	**0.45**	**1.14**	**0.27**	**0.38**	**0.32**	**0.25**	**30.96**	**28.26**	**1.14**	**1.17**	**0.12**	**0.28**

H_0= Without humic acid, H_1= Humic 2 g/L and H_3= Humic acid 4 g/L
N_1= 50 kg N/fed., N_2= 75 kg N/fed. and N_3= 100 kg N/fed.
Cv_1= Sids 12, Cv_2 = Gemmeza 11 and Cv_3 = Misr 1.
*, ** indicated significantly and highly significantly at 5% and 1% levels of probability, respectively.
N.S.: Non-significant differences and LSD = least significant difference

Concerning with wheat cultivars, data in the same Table revealed that the cultivars had a highly significantly effect on the all studied traits in the both seasons. Misr 1 cultivar gave the tallest plants (103.57 and 104.30 cm) and the greatest number of spikes/m^2 (384.17 and 361.53) in the both seasons, as well as the Gemmeza 11 cultivar gave the highest grain weight/spike (2.94 and 3.45 g), the longest spikes (13.08 and 13.64 cm), the heaviest 1000 grain (48.37 and 57.01 g) and the maximum grain yield/fed. (20.56 and 22.51 ard.) in the both seasons. The results mean that the either Gemmeza 11 or Misr 1 cultivars was the more effective for realizing the maximum values for the all studied traits. The differences among the wheat cultivars could be attributed to the genetic make up. These results are in accordance with those mentioned by Hussain *et al*. (2006), Hassanien *et al*. (2013), Fergani *et al*. (2014), Zaki *et al*. (2015), Mansour *et al*. (2016), Soloman and Anjulo (2017) and Zenhom *et al*. (2018).

Interaction effect:

Data in Table 3 pointed out that the humic acid x nitrogen fertilizer (HxN) interaction had a highly significant effect on the plant height and number of spike/m^2 in the 1st season, 1000 grain weight in the 2nd season and grain yield in both seasons. The tallest plants (108.82 cm) in the 1st season, the heaviest 1000 grain ((56.66 g) in the 2nd season and the maximum grain yield/fed. (23.29 and 24.04 ard.) in both seasons were obtained by H_2xN_3 (Humic acid 4 g/L x 100 kg N/fed.) in the 1st and 2nd seasons, respectively. Hence, the maximum grain yield/fed. may be correlated with longest spikes and the greatest 1000 grain weight. On the other hand, the thinned 1000 grain (39.89 and 44.03 g), the minimum grain yield/fed. (17.33 and 18.64 ard.), the shortest plants (87.89 and 92.67 cm) and the shortest spikes (10.80 and 11.07 cm) were stated by H_0xN_1 (control x 50 kg N/fed.) in the 1st and 2nd seasons, respectively. Hence, the relation among the three nitrogen fertilizer rates under the three humic acid was different in the both seasons.

Table 3. Interaction effect of humic acid (H) and nitrogen fertilizer (N) on the plant height (cm), yield components and yield (ard./fed.) in 2017/2018 and 2018/2019 seasons.

Characters / Interact (HxN)		Plant height (cm)		Spike length (cm)		Grain weight/ spike (g)		Number of spikes/m^2		1000-grain weight (g)		Grain yield (ard./fed.)	
		2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019
H_0	N_1	87.89	92.67	10.80	11.07	2.24	2.90	318.02	264.30	39.89	44.03	17.33	18.64
	N_2	93.70	95.02	11.35	11.95	2.67	3.46	271.06	227.13	42.48	51.08	18.69	19.96
	3_3	96.18	93.93	11.51	12.29	2.32	2.82	329.27	304.58	43.43	49.32	19.00	20.65
H_1	N_1	97.91	97.89	11.95	12.55	2.38	2.69	343.55	307.80	44.87	51.18	19.79	21.36
	N_2	99.18	98.76	12.18	12.58	2.60	2.99	307.52	282.83	45.00	52.21	20.31	21.48
	3_3	100.22	100.62	12.29	12.84	2.71	2.63	302.54	331.16	46.03	52.23	20.75	22.08
H_2	N_1	102.64	100.82	12.35	12.91	3.05	2.77	272.50	322.10	46.67	52.73	21.25	22.65
	N_2	105.13	102.81	12.73	13.31	2.80	2.76	325.80	330.66	46.38	55.18	22.19	23.23
	N_3	108.82	104.53	13.13	13.62	2.71	2.86	327.55	328.51	50.78	56.66	23.29	24.04
F-test		**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**	**N.S.**	**N.S.**	**	**	**
LSD 0.05		**1.53**	--	--	--	--	--	**43.91**	--	--	**1.77**	**0.44**	**0.39**

H_0= Without humic acid, H_1= Humic 2 g/L and H_3= Humic acid 4 g/L.
N_1= 50 kg N/fed., N_2= 75 kg N/fed. and N_3= 100 kg N/fed.
** indicated significantly at 1% level of probability.
N.S.: Non-significant differences and LSD = least significant difference

Table 4. Interaction effect of humic acid (H) and bread wheat cultivars (Cv) on the plant height (cm), yield components and yield (ard./fed.) in 2017/2018 and 2018/2019seasons.

Characters / Interact (HxCvs)		Plant height (cm)		Spike length (cm)		Grain weight/ spike (g)		Number of spikes/m^2		1000-grain weight (g)		Grain yield (ard./fed.)	
		2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019
H_0	Cv_1	87.73	91.07	11.47	12.33	2.61	3.34	270.68	238.54	42.69	50.34	18.22	19.28
	Cv_2	94.83	94.24	11.89	12.29	2.67	3.58	274.74	222.68	42.23	51.99	18.42	20.83
	Cv_3	95.10	96.31	10.31	10.69	1.94	2.25	372.94	334.79	40.88	42.10	18.38	19.14
H_1	Cv_1	93.91	92.00	12.07	12.35	2.66	2.70	291.43	294.75	44.64	52.34	19.77	20.69
	Cv_2	99.33	100.09	13.24	13.80	3.08	3.27	257.54	261.70	48.50	56.40	20.60	22.37
	Cv_3	104.07	105.18	11.11	11.82	1.95	2.34	404.64	365.34	42.76	46.88	20.49	21.86
H_2	Cv_1	98.96	92.64	12.04	12.42	3.21	2.62	270.02	330.11	42.43	50.74	21.92	22.77
	Cv_2	106.11	104.16	14.11	14.84	3.06	3.52	280.88	266.70	54.38	62.66	22.64	24.32
	Cv_3	111.53	111.40	12.07	12.58	2.29	2.25	374.94	384.47	47.01	51.17	22.17	22.82
F-test		**	**	**	**	N.S.	N.S.	N.S.	N.S.	**	**	**	**
LSD 0.05		0.78	1.96	0.46	0.66	--	--	--	--	1.96	2.03	0.21	0.49

H_0= Without humic acid, H_1= Humic 2 g/L and H_3= Humic acid 4 g/L.
Cv_1= Sids 12, Cv_2 = Gemmeza 11 and Cv_3 = Misr 1.
** indicated significantly at 1% level of probability.
N.S.: Non-significant differences and LSD = least significant difference

Table 5. Interaction effect of nitrogen fertilizer (N) and bread wheat cultivars (Cv) on the plant height (cm), yield and components yield (ard./fed.) in 2017/2018 and 2018/2019 seasons.

Characters / Interact (NxCvs)		Plant height (cm)		Spike length (cm)		Grain weight/ spike (g)		Number of spikes/m^2		1000-grain weight (g)		Grain yield (ard./fed.)	
		2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019
N_1	Cv_1	91.11	92.91	11.82	12.11	2.77	2.76	279.30	291.77	43.60	48.31	19.19	20.53
	Cv_2	97.73	97.62	12.51	13.11	2.94	3.47	261.64	244.28	45.65	54.78	19.59	22.03
	Cv_3	99.50	100.84	10.78	11.31	1.96	2.12	393.13	358.15	42.16	44.86	19.58	20.08
N_2	Cv_1	93.76	92.36	11.93	12.47	2.88	3.35	267.57	248.41	41.46	54.73	19.97	20.75
	Cv_2	100.27	99.40	13.15	13.64	3.10	3.38	257.80	251.79	48.71	57.01	20.74	22.47
	Cv_3	103.98	104.87	11.18	11.73	2.09	2.48	379.03	340.43	43.69	46.72	20.48	21.45
N_3	Cv_1	95.73	90.44	11.82	12.53	2.83	2.57	285.27	323.22	44.71	50.39	20.75	21.47
	Cv_2	102.27	101.47	13.58	14.18	2.78	3.51	293.73	255.00	50.74	59.26	21.32	23.01
	Cv_3	107.22	107.18	11.53	12.04	2.14	2.23	380.36	386.02	44.79	48.57	20.97	22.29
F-test		**	**	*	N.S.	N.S.	N.S.	N.S.	N.S.	**	**	*	**
LSD 0.05		0.78	1.96	0.46	--	--	--	--	--	1.96	2.03	0.21	0.49

N_1= 50 kg N/fed., N_2= 75 kg N/fed. and N_3= 100 kg N/fed.
Cv_1= Sids 12, Cv_2 = Gemmeza 11 and Cv_3 = Misr 1.
*, ** indicated significantly and highly significantly at 5% and 1% levels of probability, respectively.
N.S.: Non-significant differences and LSD = least significant difference

With respect to the interaction between humic acid x cultivars (HxCvs), the data in Table 4 showed that all the studied traits excreted highly significant influence by the humic acid x cultivars in both seasons. Grain weight/spike and number of spikes/m^2 did not influence by this interaction in the both seasons. The maximum grain yield/fed. (22.64 and 24.32 ard.), the longest spikes (14.11 and 14.84 cm) and the heaviest 1000 grain (54.83 and 62.66 g) in the both seasons were recorded by H_2xCv_2 (Humic acid 4 g/L x Gemmeza 11 cultivar). Moreover, the tallest plants (111.53 and 111.40 cm) were recorded by H_2xCv_3 (Humic acid 4 g/L x Misr 1 cultivar) in the 1st and 2nd seasons, respectively. The difference among the cultivars under three humic acids could be attributed to the genetic make up. However, the shortest plants (87.73 and 91.07 cm) in the 1st and 2nd seasons, respectively the lowest number of spikes/m^2 (270.80) and the minimum grain yield/fed (18.22 ard.) in the 1st season were obtained by H_0xCv_1 (Control x Sids 12 cultivar). Moreover, the shortest spikes (10.31 and 10.69 cm) in the two respective seasons and the minimum grain yield/fed. (19.14 ard.) in the 2nd season were obtained by H_0xCv_3 (Control x Misr 1 cultivar). yield/fed. Similar findings were reported by Bakry *et al*. (2013), Bakry *et al*. (2016) and El-Bassiouny *et al*. (2014).

As for the interaction between nitrogen fertilizers with wheat cultivars (NxCvs.), the results in the Table 5 declared that the nitrogen fertilizers x cultivars had a significantly effected on the plant height, 1000 grain weight and grain yield/fed. in the both seasons as well as spike length in the 1st season. However, the grain weight/spike and number of spikes/m^2 did not show any significant affected by this interaction. The heaviest 1000-grain (50.74 and 59.26 g), the maximum grain yield/fed. (21.32 and 23.01 ard.) and the longest spikes (13.58 and 14.18 cm) in the two respective seasons, as well as the greatest grains weight/spike (3.51 g) in the 2nd season were achieved by N_3xCv_2 (100 kg N/fed. x Gemmeza 11 cultivar). Moreover, the tallest plants (107.22 and 107.18 cm) in the two respective seasons and the greatest number of spikes/m^2 (386.02) in the 2nd season were achieved by N_3xCv_3 (100 kg N/fed. x Misr 1 cultivar). The difference among the cultivars under different nitrogen quantities could be attributed to the genetic make up. On the contrary, the shortest plants (91.11 and 90.44 cm) were recorded by N_1xCv_1 (50 kg N/fed. x Sids 12 cultivar) and N_3xCv_1 (100 kg N/fed. x Sids 12 cultivar) in the 1st and 2nd seasons, respectively. Moreover, the minimum mean values for grains weight/spike (1.96 and 2.12 g) in the two respective seasons and 1000 grain weight (44.86 g) in the 2nd season were recorded by N_1xCv_3 (50 kg N/fed. x Misr 1 cultivar), as well as the minimum grain yield/fed. (19.19 and 20.53 ard.) were recorded by N_1xCv_1 (50 kg N/fed. x Sids 12 cultivar) in the two respective seasons. Hence, the results may be due to the genetic variation among varieties under various nitrogen fertilizer quantities reflecting weather climatic condition. Daba (2017) found that the Kakaba cultivar at the rate of 90 kg N/ha produced the highest grain yield/ha.

With attention the second order interaction i.e. HxNxCvs (Humic acid x nitrogen fertilizers x cultivars), the data in Table 6 revealed that the studied traits i.e. plant height in the both seasons, grain weight/spike and 1000 grain weight in the 2nd season and number of spikes/m^2 in the 1st season were significantly influenced by this interaction. The tallest plants (115.33 and 113.73 cm) in two respective seasons were recorded by $H_2xN_3xCv_3$ (humic acids 4 g/L x 100 kg N/fed. x Misr 1 cultivar), as well as the longest spikes (14.47 and 15.40) in both seasons and the heaviest 1000 grain (65.50 g) in the 2nd season were obtained by $H_2xN_3xCv_2$ (humic acid 4 g/L x 100 kg N/fed. x Gemmeza 11 cultivar). Moreover, the maximum grain yield/fed. (23.73 and 24.78 ard.) in the two respective seasons and the highest grains weight/spike (4.38 g) in the 2nd season were recorded by $H_0xN_1xCv_1$ (control) x 75 kg N/fed. x Sids 12 cultivar). On the other hand, the shortest plants (90.60 cm), the thinnest 1000 grain (40.23 g) and the minimum grain yield/fed. (17.47 ard.) in the 2nd season, as well as the shortest spikes (10.00 and 10.07 cm) in both seasons were achieved by $H_0xN_1xCv_3$ (control x 50 kg N/fed. x Misr 1 cultivar). Moreover, the lowest number of spikes/m^2 (168.68) was recorded by $H_0xN_2xCv_1$ (control x 75 kg N/fed. x Sids 12 cultivar). Here, this result means the three cultivars had different behavior under agricultural practices for this investigation and reflecting the genetic make up. Asal *et al*. (2015) declared that Gemmeza 11 cultivar and 75% NPK + 1 kg humic acid produced the highest values of 100 grain weight and grains weight/spike, as well as Misr 1 cultivar and 75% NPK + 1 kg humic acid produced the highest number of spikes/m^2.

Table 5. Interaction effect of humic acid (H), nitrogen fertilizer (N) and bread wheat cultivars (Cv) on the plant height (cm), yield components and yield (ard./fed.) in 2017/2018 and 2018/2019seasons.

Character / Interaction		Plant height						Spike length (cm)						Grain weight/ spike (g)					
		2017/2018			2018/2019			2017/2018			2018/2019			2017/2018			2018/2019		
		Cv_1	Cv_2	Cv_3	Cv_1	Cv_2	Cv_3	Cv_1	Cv_2	Cv_3	Cv_1	Cv_2	Cv_3	Cv_1	Cv_2	Cv_3	Cv_1	Cv_2	Cv_3
H_0	N_1	83.44	91.27	87.77	95.33	92.07	90.60	11.60	10.80	10.00	11.80	11.33	10.07	2.31	2.68	1.73	2.84	3.77	2.07
	N_2	88.67	95.70	96.73	92.33	94.53	98.20	11.60	12.13	10.33	12.53	12.47	10.87	2.79	2.78	2.43	4.38	3.11	2.88
	N_3	90.20	97.53	100.80	85.53	96.13	100.13	11.20	12.73	10.60	12.67	13.07	11.13	2.74	2.55	1.67	2.81	3.85	1.81
H_1	N_1	92.53	98.80	102.40	92.13	98.73	102.80	12.00	12.93	10.93	12.53	13.60	11.53	2.50	3.09	1.55	2.77	3.11	2.18
	N_2	94.06	99.20	104.27	91.20	100.00	105.07	12.07	13.27	11.20	12.13	13.73	11.87	2.46	3.31	2.02	3.05	3.51	2.41
	N_3	95.13	100.00	105.53	92.67	101.53	107.67	12.13	13.53	11.20	12.40	14.07	12.07	3.01	2.85	2.28	2.29	3.18	2.42
H_2	N_1	96.47	103.13	108.33	91.27	102.07	109.13	11.87	13.80	11.40	12.00	14.40	12.33	3.51	3.05	2.59	2.65	3.52	2.13
	N_2	98.53	105.93	110.93	93.53	103.67	111.33	12.13	14.07	12.00	12.73	14.73	12.47	3.38	3.20	1.83	2.61	3.53	2.15
	N_3	101.87	109.27	115.33	93.13	106.73	113.73	12.13	14.47	12.80	12.53	15.40	12.93	2.73	2.93	2.46	2.62	3.50	2.45
F-test		**			**			N.S.			N.S.			N.S.			*		
LSD 0.05		1.35			3.04			--			--			--			0.76		

Character / Interaction		Number of spikes/m^2						1000-grain weight (g)						Grain yield (ard./fed.)					
		2017/2018			2018/2019			2017/2018			2018/2019			2017/2018			2018/2019		
		Cv_1	Cv_2	Cv_3	Cv_1	Cv_2	Cv_3	Cv_1	Cv_2	Cv_3	Cv_1	Cv_2	Cv_3	Cv_1	Cv_2	Cv_3	Cv_1	Cv_2	Cv_3
H_0	N_1	298.57	274.08	381.39	267.17	202.68	323.06	42.97	37.40	39.30	42.87	49.00	40.23	17.18	17.31	17.48	18.37	20.09	17.47
	N_2	253.84	261.48	297.87	168.68	254.42	258.28	42.73	43.40	41.30	58.33	52.50	42.40	18.59	18.84	18.64	19.37	20.90	19.62
	N_3	259.62	288.65	439.55	279.75	210.94	423.04	42.36	45.90	42.03	49.83	54.47	43.67	18.88	19.12	19.02	20.11	21.49	20.35
H_1	N_1	296.11	245.67	488.88	286.83	268.42	368.16	44.53	47.73	42.33	53.87	55.00	44.67	19.28	19.94	20.15	21.01	22.07	20.99
	N_2	303.60	238.42	380.55	253.36	238.62	356.52	43.70	48.67	42.63	52.90	56.40	47.33	19.72	20.72	20.48	20.53	22.27	21.65
	N_3	274.60	288.54	344.48	344.07	278.06	371.35	45.70	49.10	43.30	50.27	57.80	48.63	20.31	21.11	20.83	20.55	22.77	22.93
H_2	N_1	243.21	265.16	309.12	321.31	261.76	383.24	43.30	51.83	44.87	48.20	60.33	49.67	21.13	21.51	21.13	22.21	23.95	21.77
	N_2	245.27	273.48	458.66	323.19	262.32	406.48	37.93	54.07	47.13	52.97	62.13	50.43	21.58	22.67	22.32	22.36	24.24	23.08
	N_3	321.59	304.01	357.04	345.84	276.01	363.68	46.07	57.23	49.03	51.07	65.50	53.40	23.06	23.73	23.06	23.74	24.78	23.60
F-test		**			N.S.			N.S.			**			N.S.			N.S.		
LSD 0.05		92.52			--			--			3.40			--			--		

H_0= Without humic acid, H_1= Humic 2 g/L and H_3= Humic acid 4 g/L.
N_1= 50 kg N/fed., N_2= 75 kg N/fed. and N_3= 100 kg N/fed.
Cv_1= Sids 12, Cv_2 = Gemmeza 11 and Cv_3 = Misr 1.
*, ** indicated significantly and highly significantly at 5% and 1% levels of probability, respectively.
N.S.: Non-significant differences and LSD = least significant difference

References

Arjumend, T.; M.K. Abbasi and E. Ralique (2015). Effects of lignite-derived humic acid on some selected soil properties, growth and nutrient uptake of wheat (*Triticum aestivum* L.) grown under greenhouse conditions. Pakistan Journal of Botany, 47 (6): 2231-2238.

Asal, M.W.; A.B. Elham; O.M. Ibrahim and E.G. Ghalab (2015). Can humic acid replace part of the applied mineral fertilizers? A study on two wheat cultivars grown under calcareous soil conditions. Int. J. of Chem. Tech. Res., 8 (9): 20-26.

Bakry, A.B.; M.H. Taha; M.F. El-Karamany and M.T. Said (2016). Improving productivity and quality of two wheat cultivars using humic acid and zinc foliar application under sandy soil conditions. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 7 (3): 606-618.

Bakry, B.A.; T.A. Elewa; M.F. El-Kramany and A.M. Wali (2013). Effect of humic and ascorbic acids foliar application on yield and yield components of two wheat cultivars grown under newly reclaimed sandy soil. Intr. J. of Agron. and Plant Prod. Vol., 4 (6): 1125-1133.

Co-Stat Statistical Software (2004). Co-Stat Manual Revision, 4 (2): 271.

Daba, N.A. (2017). Influence of nitrogen fertilizer application on grain yield, nitrogen uptake efficiency, and nitrogen use efficiency of bread wheat (*Triticum aestivum* L.) cultivars in eastern Ethiopia. J. Agric. Sci., 9 (7): 202-217.

El-Bassiouny, H.S.M.; A.B. Bakry; A. Abd El-Monem and M.M. Abd Allah (2014). Physiological role of humic acid and nicotinamide on improving plant growth, yield and mineral nutrient of wheat (*Triticum durum*) grown under newly reclaimed sandy soil. Agric. Sci., 5: 687-700.

El-Hag, D.A.A. and A.M.E.A. Shahein (2017). Effect of different nitrogen rates on productivity and quality traits of wheat cultivars. Egypt. J. Agro. 39 (3): 321-335.

Farooq, M.; I. Khan; S. Ahmed; N. Ilyas; A. Saboor; M. Bakhtiar; S. Khan; I. Khan; N. Ilyas and A.Y. Khan (2018). Agronomical efficiency of two wheat (*Triticum aestivum* L.) varieties against different level of nitrogen fertilizer in subtropical region of Pakistan. Int. J. Environ. Agric. Res., 4 (4): 28-36.

Fergani, M.A.; M.S. El-Habbal and M.E. El-Temsah (2014). Interpretation of three wheat cultivars yield and its components with reference to sowing dates. Arab Univ. J. Agric. Sci., 22 (1): 77-82.

Gomez, K.A. and A.A. Gomez (1984). Statistical Procedure for Agricultural Research. A Wily-Inter Science Publication, John Wiley & Sons, Inc. Mew York, U.S.A., 79-411.

Haque, A.N.A.; M.E. Hossain; M.E. Haque; M.M. Hasan; M.A. Malek; M.Y. Rafii and S.M. Shamsuzzaman (2017). Response of yield, nitrogen use efficiency and grain protein content of wheat (*Triticum aestivum* L.) varieties to different nitrogen levels. Bangl. J. Bot. 46 (1): 389-396.

Hassanein, M.S.; A.G. Ahmed; N.M. Zaki; H.I. El-Alia and M.M. Tawfik (2013). Response of two wheat cultivars grown in newly cultivated lands to iron and slow release N fertilizers. Aust. J. Basic & Appl. Sci., 7 (1): 498-505.

Hussain, I.; M.A. Khan and E.A. Khan (2006). Bread wheat varieties as influenced by different nitrogen levels. J. Zhejiang Univ. Sci. B., 7 (1): 70-78.

Jaleel, C.A.; B. Sankar; P.V. Murali; M. Gomathinayagam; G.M.A. Lakshmanan and R. Panneerselvam (2008). Water deficit stress effects on reactive oxygen metabolism in Catharanthusroseus: impacts on ajmalicine accumulation. Colloids Surf Biointerfaces, 62: 105-111.

Khan, R.U.; M.Z. Khan; A. Khan; S. Saba; F. Hussain and I.U. (2018). Effect of humic acid on growh and crop nutrient status of wheat on two different soils. Journal of Plant Nutrition, 41 (4): 453-460.

Manal, F.M.; A.T. Thalooth; G. Amal ahmed; M.H. Mohamed and T.A. Elewa (2016). Evaluation of the effect of chemical fertilizer and humic acid on yield and yield components of wheat plants (*Triticum aestivum*) grown under newly reclaimed sandy soil. Int. J. of Chem. Tech. Res., 9 (8): 154-161.

Mansour, H.A.; S. Kh. Pibars; M.S. Gaballah and K.A.S. Mohammed (2016). Effect of different nitrogen levels, and wheat cultivars on yield and its components under sprinkler irrigation system management in sandy soil. Int. J. Chem. Tech. Res., 9 (9): 1-9.

Merwad, A.R.M.A. (2019). Using humic substances and foliar spray with moringa leaf extract to alleviate salinity stress on wheat. Handbook of Environmental Chemistry, 77: 265-286.

Molasadeghi, V. and R. Shahryari (2011). Grouping bread wheat genotypes under terminal drought in the presence of humic fertilizer by use of multivariate statistical analysis. Advances in Environmental Biology, 5 (3): 510-515.

Rekaby, S.A.; M.A. Eissa; S.A. Hegab and H.M. Ragheb (2016). Effect of nitrogen fertilization rates on wheat grown under drip irrigation system. Assiut J. Agric. Sci., 47 (3): 104-119.

Solomon, W. and A. Anjulo (2017). Response of bread wheat varieties to different levels of nitrogen at Doyogena, Southern Ethiopia. Int. J. Sci. and Res., 7 (2): 452-459.

Zaki, N.M.; A.G. Ahmed; M.S. Hassanein and M.E. Gobarah (2015). Response of two wheat cultivars to foliar fertilizer in newly cultivated land. Gobarah. Middle East J. Agric. Res., 4 (2): 283-290.

Zenhom, M.F.T.; G.Y. Hammam and S.A.S. Mehasen (2018). Wheat lodging and yield in response to cultivars and foliar application of paclobutrazol. 4th International Confernce on Biotechnology Applications in Agriculture (ICBAA), Benha University, Moshtohor and Hurghada, 4-7 April 2018, Egypt.

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تأثير حمض الهيوميك والتسميد النيتروجيني علي إنتاجية بعض أصناف قمح الخبز

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الملخص

أقيمت تجربة حقلية بمزرعة قسم المحاصيل البحثية بكلية الزراعة – جامعة أسيوط –خلال موسمي ٢٠١٧/٢٠١٨ و ٢٠١٨/٢٠١٩ لبحث تأثير حمض الهيوميك والتسميد النيتروجيني علي إنتاجية بعض أصناف قمح الخبز، وكان التصميم المستخدم هو القطاعات الكاملة العشوائية بترتيب الشرائح المنشقة مرة واحدة في ثلاث مكررات، حيث تم وضع معاملات حمض الهيوميك [صفر (كنترول) ، حمض الهيوميك ٢ جم/لتر وحمض الهيوميك ٤ جم/لتر وهي H_0 ، H_1 ، H_2] أفقياً، ومعدلات التسميد النيتروجيني (٥٠ ، ٧٥ و ١٠٠ كجم ن/فدان وهي N_1 ، N_2 ، N_3) رأسياً وأصناف القمح (سدس ١٢ وجميزه ١١ ومصر ١ وهي Cv_1 ، Cv_2 و Cv_3) في الأحواض المنشقة.

ويمكن تلخيص أهم النتائج المتحصل عليها كما يلي:

- سجلت معاملة حمض الهيوميك ٤ جم/لتر أطول النباتات والسنابل وأثقل ألف حبة وأعظم محصول الحبوب/ فدان في كلا الموسمين وأعلا وزن الحبوب/سنبلة في الموسم الأول وأعلا عدد سنابل/م٢ في الموسم الثاني.
- ازدادت معظم الصفات محل الدراسة بزيادة معدل التسميد النيتروجيني حتي ١٠٠ كجم ن/فدان، كما تم الحصول علي أعلا وزن للحبوب/سنبلة عند ٧٥ كجم ن/فدان في كلا الموسمين.
- تفوق الصنف جيزة ١١ علي الصنفين سدس ١٢ ومصر ١ وأعطي أعلا القيم لصفات طول السنبلة، وزن الألف حبة ومحصول الحبوب/فدان في كلا الموسمين وأعلا وزن حبوب/سنبلة في الموسم الثاني، بينما أعطي الصنف مصر ١ أطول النباتات وأعظم عدد سنابل/م٢ في كلا الموسمين.
- أعطت معاملة التفاعل الثنائي H_2xN_3 (حمض الهيوميك ٤ جم/لتر× التسميد ١٠٠ كجم ن/فدان) وأعلا وزن ١٠٠٠ حبة ومحصول الحبوب/ فدان وأطول النباتات والسنابل في كلا الموسمين علاوة علي ذلك أعطت معاملتي التفاعل الثنائي H_2xCv_3 (حمض الهيوميك ٤ جم/لتر × الصنف مصر ١) و N_3xCv_3 (التسميد ١٠٠ كجم ن/فدان × الصنف مصر ١) أعلي متوسطات القيم لمعاملات طول النبات وعدد السنابل / م٢ ومحصول الحبوب/فدان في كلا الموسمين.
- حققت معاملة التفاعل الثلاثي $H_2xN_3xCv_2$ (حمض الهيوميك ٤ جم/لتر × التسميد ١٠٠ كجم ن/فدان × الصنف جميزة ١١) أعلا متوسطات القيم لصفات طول السنبلة، وزن ١٠٠٠ حبة ومحصول الحبوب/ فدان في كلا الموسمين، كما حققت المعاملة $H_2xN_3xCv_3$ (حمض الهيوميك ٤ جم/لتر × التسميد ١٠٠ كجم ن/فدان × الصنف مصر ١) أطول النباتات في كلا الموسمين.