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INTEGRATED IMPACTS OF HUMIC ACID, HALOTOLERANT N_2 FIXERS AND NITROGEN APPLICATION ON WHEAT YIED *(Triticum aestivum L.)*,YIELD COMPONENT AND NUTRIENT UPTAKE

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ABSTRACT

To study the integrated impacts of halotolerant N_2 fixers and humic acid application on N – availability and nutrient contents of wheat crop (*Triticum Aestivum L*). CV Sakha 93 in asalt affected soil, two successive field experiments were conducted in El-Matarya District near Al Manzala Lake, Dakahlia Governorate during the winter of 2009-2010 and 2010-2011 seasons. Eighteen treatments were arranged in asplit-split block design, which were the simple possible combination between two treatments of humic acid (with (50 L fed^{-1}. & without) as the main plots, three treatments of bio inoculation (Non-inoculation, Azotobacter+ Azospirillum and Nostoc + Anabaena) as the sub plots and three levels of nitrogen fertilization (control, 40 and 80 Kg N fed^{-1}) as sub- sub plots. Each treatment was replicated three times. Thus, the total number of plots used for each season were 54 plots.

The results of this investigation revealed that:

- With adding humic acid, the mean values No. of grains spike^{-1}, spike length (cm), weight of 1000 seeds (g), grain yield (ardab fed^{-1}), straw yield (ton fed^{-1}), N, P and K-uptake (kg fed^{-1}) of grain, straw and whole plant at harvesting stage were significantly increased due to addition of humic acid.
- This investigation also indicated that an application of Azotobacter+ Azospirillum was more effective for increasing the No. of grains spike^{-1}, spike length (cm), weight of 1000 seeds (g), grain yield (ardab fed^{-1}), straw yield (ton fed^{-1}), N, P and K-uptake (kg fed^{-1}) of grain, straw and whole plant at harvesting stage than the other halotolerant N_2 fixers and this effect was significance during both seasons of the experimentation.
- Concerning the effect of N-fertilization the average values of No. of grains spike^{-1}, spike length (cm), weight of 1000 grains (g), grain yield (ardab fed^{-1}), straw yield (ton fed^{-1}), N, P and K-uptake (kg fed^{-1}) of grain, straw and whole plant at harvesting stage for wheat plant treated with 80 kg N fed^{-1} doses of N-fertilization was more increased significantly than that treated with the untreated plant.
- With respect to the interactive effect between adding humic acid, halotolerant N2 fixers and nitrogen application found that with adding 4080 kg N fed^{-1} of nitrogen fertilization mixed with Azt+Azs in presence of humic acid gave the highest value of No. of grains spike^{-1}, spike length (cm), weight of 1000 seeds (g), grain yield (ardab fed^{-1}), straw yield (ton fed^{-1}), N, P and K-uptakes (kg fed^{-1}) of grain, straw and whole plant at harvesting stage for wheat plant.

Keywords: Humic acid, halotolerant N_2 fixers, N fertilization, wheat plants, salt affected soil, N,P and K uptake by wheat plant.

INTRODUCTION

Nowadays, great efforts are exerted in order to increase the amount of food in Egypt by applying recommended cultural practices push as using bio and chemical fertilizers for wheat crop production to decrease the gap between consumption and production (El-Zeky, 2005).

Humic substances are well known as complexing agents for transition metal cations, thereby facilitating enhanced uptake. Several researchers reported that high wheat yields require increases in N application and the excessive addition of this nutrient can contribute to watercourse pollution (Semenov *et al.,* 2007). Therefore, the use of high N rates that allow expressing yield potential of existing varieties in the actual market require careful and efficient management of nutrient partialization with the purpose of minimizing losses due to lixiviation during crop development, avoiding pollution of the underground water tables and its harmful effect on human health and environmental sustainability.

The halotolerant microorganisms are effective in the treatment of waste from tannery industry or pickle industry (Kubo *et al.,* 2001, Sivaprakasam *et al.,* 2008). These organisms are isolated from sources such as marine environment, soils, rhizosphere or industrial waste. They are also known to be the potential sources of extracellular enzymes with novel properties, useful for diverse industrial applications. Wheat (*Triticum aestivum, L.*) is one of the main cereal crops all over the world and one of the most important winter crops in Egypt. The main objective of this investigation is to study the integrated impacts of humic acid and N fertilization as well as halotolerant N_2 fixers application on N– availability and nutrient contents of wheat crop (Triticum Aestivum L). CV Sakha 93 in salt affected soils.

MATERIALS AND METHODS

Plant culture & experimental conditions

Three-factor experiment were conducted at El-Matarya District near Al Manzala Lake, Dakahlia Governorate, using the wheat crop (*Triticum aestivum L*) culivar Sakha 93 during the two 2009-2010 and 2010-2011seasons. The factors studied were humic acid, halotolerant N_2 fixers and soil nitrogen application on wheat yield and nutrient contents.

Three-factor experiment with 18 treatments were arranged in asplit-split block design, which were the simple possible combination between two treatments of humic acid (with (50 L fed^{-1}. & without) as the main plots, three treatments of bio inoculation (Non-inoculation, Azotobacter+ Azospirillum and Nostoc + Anabaena) as sub plots and three levels of nitrogen fertilization (control, 40 and 80 Kg N fed-1) as sub- sub plots. Each treatment was replicated three times. Thus, the total number of plots used for each season was 54 plots. Every plot area of $4m^2$ (2 x 2 m) was build-up and the total area was 216 m^2.

Cultivation

Wheat seeds cv. Sakha 93 were planted on 15th November 2009 and 2010 in hills 20 cm apart on the middle of raw. Then, irrigation was carried out at field capacity. Wheat was irrigated after planting four times during the growing season. Some physical and chemical properties of the experimental soil are shown in table 1.

Table 1: Some physical and chemical properties of the experimental soil during season 2011.

Depth(cm)	pH 1:2.5	ECdSm^{-1}	Ions meq 100 g^{-1} soil							
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO3^{=}$	HCO_3^{-}	Cl^{-}	$So_4^{=}$
0-30	8.18	1.66	1.95	1.05	4.92	0.58	-	1.47	4.16	2.87
30-60	8.12	1.83	2.12	1.19	5.59	0.36	-	1.33	4.39	3.65
60-90	8.05	1.98	2.21	1.32	6.36	0.25	-	1.19	4.63	4.32
Mechanical analysis %						**Sp %**	**O.M %**	**Available nutrients (mg kg^{-1} soil)**		
	C.sand	**F.sand**	**Silt**	**Clay**	**Texture**			**N**	**P**	**K**
0-30	1.8	19.6	29.2	49.4	**Clay**	79.4	1.50	48.2	7.2	420
30-60	1.4	15.7	31.4	51.4	**Clay**	80.8	1.04	43.1	6.1	375
60-90	0.7	10.2	35.7	53.4	**H. Clay**	82.3	0.72	30.6	4.9	322

Before sowing, FYM was added at the rate of (20 m^3. fed^{-1}) and irrigated with water at the saturation percentage. Then, left for two weeks to elucidate the damage on seeds and their roots resulted from the heat of decomposition.

Humic acid was applied to the soil on the mean of spray at rate of 50 L fed^{-1} (each plot received 500 ml was diluted in 60 liters of irrigation water and given as spray to the soil at sowing). The chemical analysis of humic acid is shown in Table 2.

Table 2: Some chemical properties of humic acid.

EC (d Sm^{-1})	pH	OM%	Macronutrients (%)			Micronutrients (mg kg^{-1})		
			N	P	K	Zn	Fe	Mn
0.90	7.8	65	5.60	0.18	4.90	248	409	244

The efficient strains of bacteria (Non-inoculation, Azotobacter+ Azospirillum and Nostoc + Anabaena) in peat growth media were obtained from General Organization for Agriculture Equalization Fund (GDAEF), Ministry of Agriculture and Land Reclamation, Egypt. Cultures of previous bio inoculants at 500 ml (1012 cells ml^{-1}) was diluted in 500 liters of water fed^{-1} and given as spray to the soil at sowing.

Concerning mineral fertilizers, urea (46 % N), super phosphate (15.5 % P_2O_5) and potassium sulphate (48 % K_2O) were the respective of N, P and K sources. Nitrogen fertilizer was added to plots in three doses the first was 20% from recommended doses after sowing and before irrigation directly, the second was 40 % from recommended doses at the first irrigation, and the third was 40% from recommended doses at booting stage.

Potassium was applied at the rate of 150 Kg K fed^{-1} as a one dose before the third irrigation. As for phosphorus fertilizer was added at sowing in single dose.

Three plants were taken after124 days (filling stage) from wheat seeds sowing, from each plot and carried immediately to the laboratory, Plant samples were separated; weight and oven dried at 70°c till constant weight was reached. The dried plant were thoroughly ground and stored for chemical analysis.

Soil analysis:

Particle size distribution was described by Piper (1950), pH value, EC, soluble carbonate and bicarbonate, soluble calcium, magnesium, soluble sodium, soluble chloride and potassium and sulfate was measured in the 1:2.5 soil water suspension as described by Jackson (1967). Water saturation capacity was determined by the method described by the U.S.Salinity Laboratory Staff (1954). Organic matter was determined according to Walkley and Black method, (Black (1965). Available N was described by Bremner and Mulvany (1982). Available phosphorus was determined following the method of Olsen, S. R. and L. E. Sommers (1982). Available potassium was determined according to Black (1965).

Plant Analysis*:*

The oven dry plant samples were ground and wet digested by sulphuric perchloric acid mixture as described by Peterburgski (1986). With respect to N, P, and K uptake values were calculated by multiplying the percentage of such elements by dry weight of the plants per plot in plot experiment and per 1 fed in field experiment and expressed as g $plant^{-1}$ at harvesting stage.

Statistical analysis:-

All data were statistically analyzed according to the technique of analysis of variance (ANOVA) and the least significant difference (L.S.D) method was used to compare the deference between the means of treatment values to the methods described by Gomez and Gomez, (1984). All statistical analyses were performed using analysis of variance technique by means of COSTATE Computer Software.

RESULTS AND DISCUSSION

Data presented in Table ٣ show that; the highest mean values 56.59, 57.17 in 1^{st} and 2^{nd} for No. of grains $spike^{-1}$, 20.15, 20.35 in 1^{st} and 2^{nd} spike length (cm), and 84.89, 85.76 cm in 1^{st} and 2^{nd} for weight of 1000 seeds (g) obtained from 40 kg N fed^{-1} jointly with Azt + Azs in presence of humic. Meanwhile, the lowest mean values were 38.50, 39.31 in 1^{st} and 2^{nd} for No. of grains $spike^{-1}$, 13.71, 13.99 in 1^{st} and 2^{nd} spike length (cm), and 57.75, 58.961in 1^{st} and 2^{nd} for weight of 1000 seeds (g) obtained from untreated wheat. This trend was significantly in the 1^{st} season, while the 2^{nd} season had no significantly effect.

Table 3: Interaction effect of humic acid, halotolerant N_2 fixers and nitrogen application on No. of grains spike^{-1}, spike length (cm) and weight of 1000 seeds (g) at the harvesting stage during both seasons of the experiment.

Char. Treat.			No. of grains spike^{-1}		Spike length (cm)		weight of 1000 seeds (g)	
			1st	2nd	1st	2nd	1st	2nd
Without humic	Non-inoculation	Cont.	38.50	39.31	13.71	13.99	57.75	58.96
		40 N fed^{-1}	41.63	42.08	14.82	14.98	62.44	63.11
		8٠ N fed^{-1}	43.28	44.31	15.41	15.77	64.92	66.46
	Mean		**41.14**	**41.90**	**14.64**	**14.91 16.57**	**61.71**	**62.85**
	Azt+Azs	Cont.	42.08	42.52	14.98	15.14	63.11	63.78
		40 N fed^{-1}	48.64	49.58	17.32	17.65	72.96	74.37
		8٠ N fed^{-1}	47.39	48.28	16.87	17.19	71.09	72.43
	Mean		**46.04**	**46.80**	**16.39**	**16.66 18.51**	**69.05**	**70.19**
	Nostoc + *Anabaena*	Cont.	39.13	39.98	13.93	14.23	58.69	59.97
		40 N fed^{-1}	45.96	46.63	16.36	16.60	68.94	69.95
		8٠ N fed^{-1}	44.98	45.38	16.01	16.15	67.47	68.07
	Mean		**43.36**	**44.00**	**15.43**	**15.66 17.40**	**65.03**	**66.00**
Average			**43.49**	**44.21**	**15.48**	**15.74 17.48**	**65.24**	**66.31**
With humic	Non-inoculation	Cont.	45.43	46.01	16.17	16.38	68.14	69.01
		٤٠ N fed^{-1}	47.03	48.02	16.74	17.09	70.55	72.03
		8٠ N fed^{-1}	51.50	52.04	18.33	18.52	77.25	78.06
	Mean		**47.99**	**48.69**	**17.08**	**17.33 19.26**	**71.98**	**73.03**
	Azt+Azs	Cont.	50.83	50.79	18.09	18.08	76.25	76.18
		٤٠ N fed^{-1}	56.59	57.17	20.15	20.35	84.89	85.76
		8٠ N fed^{-1}	54.54	55.97	19.41	19.92	81.81	83.95
	Mean		**53.99**	**54.64**	**19.22**	**19.45 21.61**	**80.98**	**81.96**
	Nostoc + *Anabaena*	Cont.	48.28	48.69	17.19	17.33	72.43	73.03
		٤٠ N fed^{-1}	54.94	55.70	19.56	19.83	82.41	83.55
		8٠ N fed^{-1}	54.67	54.81	19.46	19.51	82.01	82.21
	Mean		**52.63**	**53.06**	**18.74**	**18.89 20.99**	**78.95**	**79.60**
Average			**51.54**	**52.13**	**18.35**	**18.56 20.62**	**77.30**	**78.20**
Inter. Sig.			**	N.S	**	N.S	**	N.S
LSD at 0.05			**0.67**	**N.S**	**0.26**	**N.S**	**1.01**	**N.S**

***Azt :Azotobacter** ***Azs : Azospirillum**

It was observed that plants grown well due to the application of microorganisms and humic substances which stimulate the plant yields. This may be due to the higher frequency of bio fertilization with the availability of soil moisture which leads to the effective absorption of nutrients and better proliferation of roots which might increase crop yield (Omer, *et al.,* 2004). There are also many reports of humic substances role in promoting plant biomass, stimulation of seed, straw and even direct effect on crop productivity and increases in crop yields.

A reference to Table ٤, findings point out that the highest mean values of grain yield were 14.78, 14.93 ardab fed^{-1} in 1st and 2nd and 8.02, 8.11 ton fed^{-1} in 1st and 2nd for straw yield obtained from 40 kg N fed^{-1} jointly with Azt+Azs in presence of humic Meanwhile, the lowest mean values of grain yield were 10.06, 10.27 ardab fed^{-1} in 1st and 2nd and 5.46, 5.57 ton fed^{-1} in 1st and 2nd for straw yield obtained from untreated wheat. This trend was significantly in the 1st season, while the 2nd season had no significantly effect.

Table 4: Interaction effect of humic acid, halotolerant N_2 fixers and nitrogen application on grains yield (ardab fed^{-1}) and straw yield (ton fed^{-1}) at the third stage during both seasons of the experiment.

Char. Treat.			Grain yield ardab fed^{-1}		straw yield ton fed^{-1}	
			1st	2nd	1st	2nd
Without humic	Non-inoculation	Cont.	10.06	10.27	5.46	5.57
		40 N fed^{-1}	10.87	10.99	5.90	5.97
		8٠ N fed^{-1}	11.31	11.57	6.14	6.28
	Mean		**10.75**	**10.94**	**5.83**	**5.94**
	Azt+Azs	Cont.	10.99	11.11	5.97	6.03
		40 N fed^{-1}	12.71	12.95	6.90	7.03
		8٠ N fed^{-1}	12.38	12.61	6.72	6.85
	Mean		**12.02**	**12.22**	**6.53**	**6.64**
	Nostoc + *Anabaena*	Cont.	10.22	10.44	5.55	5.67
		40 N fed^{-1}	12.01	12.18	6.52	6.61
		8٠ N fed^{-1}	11.75	11.85	6.38	6.43
	Mean		**11.32**	**11.49 6.24**	**6.15**	**6.24**
Average			**11.36**	**11.55**	**6.17**	**6.27**
With humic	Non-inoculation	Cont.	11.87	12.02	6.44	6.52
		40 N fed^{-1}	12.29	12.54	6.67	6.81
		8٠ N fed^{-1}	13.45	13.59	7.30	7.38
	Mean		**12.53**	**12.72**	**6.80**	**6.90**
	Azt+Azs	Cont.	13.28	13.27	7.21	7.20
		40 N fed^{-1}	14.78	14.93	8.02	8.11
		8٠ N fed^{-1}	14.25	14.62	7.73	7.94
	Mean		**14.10**	**14.27**	**7.65**	**7.75**
	Nostoc + *Anabaena*	Cont.	12.61	12.72	6.85	6.90
		40 N fed^{-1}	14.35	14.55	7.79	7.90
		8٠ N fed^{-1}	14.28	14.32	7.75	7.77
	Mean		**13.75**	**13.86**	**7.46**	**7.52 7.39**
Average			**13.46**	**13.62**	**7.31**	**7.39**
Inter. Sig.			**	N.S	**	N.S
LSD $_{at\ 0.05}$			**0.17**	**N.S**	**0.10**	**N.S**

The interaction effect between the previously mentioned parameters data in Table ٥ also detected that, the highest mean values 513.45 for N-uptake (kg fed^{-1}) in 1st obtained from 80 Kg fed^{-1} jointly with Azt+Azs in without humic, 58.8 for K -uptake (kg fed^{-1}) in 2nd obtained from 80 Kg fed^{-1} jointly with non-inoculation in presence humic, 462, 34.86 for N-uptake (kg fed^{-1}), P-uptake (kg fed^{-1}) in 2nd obtained from nitrogen cont. jointly with Azt+Azs in presence humic and 43.785, 82.95 for P-uptake (kg fed^{-1}), K-uptake (kg fed^{-1}) in 1st obtained from 40 Kg fed^{-1} jointly with Azt+Azs in presence humic. ,Meanwhile, the lowest mean values of 360.15 for N-uptake (kg fed^{-1}) in 1st obtained from nitrogen cont. jointly with Nostoc + Anabaena in presence humic , 20.685, 38.85 for P, K in 1st obtained from untreated wheat and 117.6, 7.77 ,13.65 for N-uptake (kg fed^{-1}), P -uptake (kg fed^{-1}) and K -uptake (kg fed^{-1}) obtained from nitrogen cont. jointly with non-inoculation in presence humic.This trend was significantly in the 2nd season only.

Table 5: Interaction effect of humic acid, halotolerant N2 fixers and nitrogen application on N, P and K uptake at the harvesting stage of grains during both seasons of the experiment.

Char. Treat.			N-uptake (kg fed^{-1})		P-uptake (kg fed^{-1})		K-uptake (kg fed^{-1})	
			1st	2nd	1st	2nd	1st	2nd
Without humic	**Non-inoculation**	**Cont.**	404.25	216.3	20.685	11.34	38.85	22.05
		٤٠ N fed^{-1}	417.9	154.35	26.565	9.66	50.4	19.95
		8٠ N fed^{-1}	487.2	245.7	32.76	15.96	67.2	34.65
	Mean		**436.45**	**205.45**	**26.67**	**12.32**	**52.15**	**25.55**
	Azt+Azs	**Cont.**	391.65	180.6	24.045	10.71	44.1	19.95
		٤٠ N fed^{-1}	465.15	255.15	35.49	18.69	78.75	45.15
		8٠ N fed^{-1}	513.45	254.1	39.165	19.11	77.7	42
	Mean		**456.75**	**229.95**	**32.9**	**16.17**	**66.85**	**35.7**
	Nostoc + ***Anabaena***	**Cont.**	385.35	240.45	22.05	13.545	38.85	26.25
		٤٠ N fed^{-1}	490.35	302.4	36.225	25.515	79.8	46.2
		8٠ N fed^{-1}	407.4	284.55	28.77	19.74	63	42
	Mean		**427.7**	**275.8**	**29.015**	**19.6**	**60.55**	**38.15**
Average			**440.3**	**237.0667**	**29.52833**	**16.03**	**59.85**	**33.13333**
With humic	**Non-inoculation**	**Cont.**	474.6	117.6	32.235	7.77	52.5	13.65
		٤٠ N fed^{-1}	394.8	220.5	28.14	15.54	47.25	26.25
		8٠ N fed^{-1}	436.8	407.4	34.755	32.235	64.05	58.8
	Mean		**435.4**	**248.5**	**31.71**	**18.515**	**54.6**	**32.9**
	Azt+Azs	**Cont.**	428.4	462	33.075	34.86	56.7	54.6
		٤٠ N fed^{-1}	508.2	349.65	43.785	29.82	82.95	57.75
		8٠ N fed^{-1}	508.2	323.4	42.105	26.775	73.5	47.25
	Mean		**481.6**	**378.35**	**39.655**	**30.485**	**71.05**	**53.2**
	Nostoc + ***Anabaena***	**Cont.**	360.15	330.75	26.565	24.255	45.15	37.8
		٤٠ N fed^{-1}	432.6	241.5	36.75	20.16	67.2	36.75
		8٠ N fed^{-1}	371.7	353.85	30.24	28.245	53.55	49.35
	Mean		**388.15**	**308.7**	**31.185**	**24.22**	**55.3**	**41.3**
Average			**435.05**	**311.85**	**34.1833**	**24.41**	**60.31667**	**42.47**
Inter. Sig.			**N.S**	**	**N.S**	**	**N.S**	**
LSD at 0.05			**N.S**	**0.87**	**N.S**	**0.064**	**N.S**	**0.11**

A glance of the interaction effect between the previously mentioned parameters data in Table 6 also detected that; the highest mean values

70.35, 76.65in 1st and 2nd for N-uptake (kg fed^{-1}), 7.665, 7.65 in 1st and 2nd for P-uptake (kg fed^{-1})and 59.85, 65.1 in 1st and 2nd for K-uptake (kg fed^{-1}) obtained from 40 kg N fed^{-1} jointly with Azt+Azs in presence of humic..

Table 6: Interaction effect of humic acid, halotolerant N2 fixers and nitrogen application on N, P and K uptake at the harvesting stage of straw during both seasons of the experiment.

Char. Treat.			N-uptake (kg fed^{-1})		P-uptake (kg fed^{-1})		K-uptake (kg fed^{-1})	
			1st	2nd	1st	2nd	1st	2nd
Without humic	Non-inoculation	Cont.	26.25	29.4	1.99	1.89	21	23.1
		٤٠ N fed^{-1}	32.55	35.7	2.73	2.625	27.3	30.45
		8٠ N fed^{-1}	36.75	40.95	3.045	2.94	32.55	35.7
	Mean		**31.85**	**35.35**	**2.59**	**2.485**	**26.95**	**29.75**
	Azt+Azs	Cont.	32.55	34.65	2.52	2.415	26.25	28.35
		٤٠ N fed^{-1}	48.3	53.55	4.515	4.41	40.95	46.2
		8٠ N fed^{-1}	46.2	50.4	3.99	3.885	38.85	42
	Mean		**42.35**	**46.2**	**3.675**	**3.57**	**35.35**	**38.85**
	Nostoc + *Anabaena*	Cont.	28.35	30.45	2.205	2.1	22.05	25.2
		٤٠ N fed^{-1}	42	47.25	3.57	3.675	36.75	39.9
		8٠ N fed^{-1}	39.9	43.05	3.255	3.15	32.55	37.8
	Mean		**36.75**	**40.25**	**3.01**	**2.975**	**30.45**	**34.3**
Average			**36.98**	**40.6**	**3.092**	**3.01**	**30.91667**	**34.3**
With humic	Non-inoculation	Cont.	39.9	43.05	3.255	3.255	32.55	36.75
		٤٠ N fed^{-1}	43.05	48.3	3.885	3.675	34.65	38.85
		8٠ N fed^{-1}	54.6	58.8	5.565	5.355	43.05	48.3
	Mean		**45.85**	**50.05**	**4.235**	**4.095**	**36.75**	**41.3**
	Azt+Azs	Cont.	50.4	54.6	5.145	4.935	40.95	46.2
		٤٠ N fed^{-1}	70.35	76.65	7.665	7.56	59.85	65.1
		8٠ N fed^{-1}	63	70.35	6.93	6.825	52.5	59.85
	Mean		**61.25**	**67.2**	**6.58**	**6.44**	**51.1**	**57.05**
	Nostoc + *Anabaena*	Cont.	45.15	49.35	4.41	4.41	37.8	42
		٤٠ N fed^{-1}	66.15	71.4	7.245	7.14	55.65	60.9
		8٠ N fed^{-1}	59.85	64.05	6.3	6.195	48.3	54.6
	Mean		**57.05**	**61.6**	**5.985**	**5.915**	**47.25**	**52.5**
Average			**54.72**	**59.62**	**5.6**	**5.48**	**45.03333**	**50.28**
Inter. Sig.			**	**	**	**	**	**
LSD at 0.05			**0.02**	**0.02**	**0.002**	**0.002**	**0.02**	**0.02**

Meanwhile, the lowest mean values were 26.25, 29.4 cm in 1st and 2nd for N-uptake (kg fed^{-1}), 1.99, 1.89 in 1st and 2nd for P-uptake (kg fed^{-1}) and 21, 23.1 in 1st and 2nd for K-uptake (kg fed^{-1})obtained from untreated wheat. This trend was significantly in the 1st and 2nd season

About the interaction effect between the previously mentioned parameters data in Table 7 also detected that; the highest mean values 578.55, 51.45, 142.8, 122.85 for N-uptake (kg fed^{-1}) in 1st, P-uptake (kg fed^{-1}) in 1st and K-uptake (kg fed^{-1}) in 1st and 2nd obtained from 40 kg N fed^{-1} jointly with Azt+Azs in presence of humic, 516.6 for N-uptake (kg fed^{-1}) in 2nd,39.80 for P-uptake (kg fed^{-1}) in 2nd obtained from nitrogen cont. jointly with Azt+Azs in presence of humic, Meanwhile, the lowest mean values were 405.3 for N-uptake (kg fed^{-1}) in 1st obtained from nitrogen cont. jointly with Nostoc + Anabaena in presence of humic, 160.65 , 11.03 for N-uptake (kg fed^{-1}) in 2nd P-uptake (kg fed^{-1}) in 2nd obtained from obtained from nitrogen cont. jointly with non-inoculation in presence humic,22.68, 59.85, 45.15 for P-uptake (kg fed^{-1}) in 1st and K-uptake (kg fed^{-1}) in 1st and 2nd obtained fromuntreated wheat. This trend was significantly in the 2nd season only. It is well known that humic substances increases soil's cation exchange capacity (ability to hold and release cations such as K^+, Ca^{++}, or NH_4^+), and also can form aqueous complexes with micronutrients, though not to the same extent as many synthetic chelating agents (Mikkelsen, 2005). Since humic acid holds cations so they could be absorbed by a plant's root, improving micronutrient exchange and transference to the plant's circulation system (Adani *et al.,* 1998).

Table 7: Interaction effect of humic acid, halotolerant N2 fixers and nitrogen application on N, P and K uptake at the harvesting stage of whole plant during both seasons of the experiment.

Char. Treat.			N-uptake (kg fed^{-1})		P-uptake (kg fed^{-1})		K-uptake (kg fed^{-1})	
			1st	2nd	1st	2nd	1st	2nd
Without humic	**Non-inoculation**	**Cont.**	430.5	245.7	22.68	13.23	59.85	45.15
		٤٠ N fed^{-1}	450.45	190.05	29.295	12.285	77.7	50.4
		8٠ N fed^{-1}	523.95	286.65	35.805	18.9	99.75	70.35
	Mean		**468.3**	**240.8**	**29.26**	**14.805**	**79.1**	**55.3**
	Azt+Azs	**Cont.**	424.2	215.25	26.565	13.125	70.35	48.3
		٤٠ N fed^{-1}	513.45	308.7	40.005	23.1	119.7	91.35
		8٠ N fed^{-1}	559.65	304.5	43.155	22.995	116.55	84
	Mean		**499.1**	**276.15**	**36.575**	**19.74**	**102.2**	**74.55**
	Nostoc + *Anabaena*	**Cont.**	413.7	270.9	24.255	15.645	60.9	51.45
		٤٠ N fed^{-1}	532.35	349.65	39.795	29.19	116.55	86.1
		8٠ N fed^{-1}	447.3	327.6	32.025	22.89	95.55	79.8
	Mean		**464.45**	**316.05**	**32.025**	**22.575**	**91**	**72.45**
Average			**477.2833**	**277.6667**	**32.62**	**19.04**	**90.766 67**	**67.433**
With humic	**Non-inoculation**	**Cont.**	514.5	160.65	35.49	11.03	85.05	50.4
		٤٠ N fed^{-1}	437.85	268.8	32.025	19.215	81.9	65.1
		8٠ N fed^{-1}	491.4	466.2	40.32	37.59	107.1	107.1
	Mean		**481.25**	**298.55**	**35.945**	**22.61**	**91.35**	**74.2**
	Azt+Azs	**Cont.**	478.8	516.6	38.22	39. 80	97.65	100.8
		٤٠ N fed^{-1}	578.55	426.3	51.45	37.38	142.8	122.85
		8٠ N fed^{-1}	571.2	393.75	49.035	33.6	126	107.1
	Mean		**542.85**	**445.55**	**46.235**	**36.925**	**122.15**	**110.25**
	Nostoc + *Anabaena*	**Cont.**	405.3	380.1	30.975	28.665	82.95	79.8
		٤٠ N fed^{-1}	498.75	312.9	43.995	27.3	122.85	97.65
		8٠ N fed^{-1}	431.55	417.9	36.54	34.44	101.85	103.95
	Mean		**445.2**	**370.3**	**37.17**	**30.135**	**102.55**	**93.8**
Average			**489.7667**	**371.46**	**39.78**	**29.89**	**105.35**	**92.75**
Inter. Sig.			**	**	**	**	**	**
LSD at 0.05			**2.70**	**1.40**	**0.03**	**0.04**	**0.12**	**0.10**

CONCLUSION

It could be recommended that inoculation of wheat plant with the mixture of multi strains inoculants (Azotobacter + Azospirillum) combined with humic acid (50 L fed^{-1}.) under N-fertilization at rate of 40 kg N fed^{-1} are considered as the most suitable treatment for realizing the highest economic yield and the best quality parameters for wheat plants.

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التأثير المتداخل للتسميد الحيوى والنيتروجينى فى وجود حمض الهيوميك على محصول القمح ،مكوناتة و امتصاص العناصر الغذائية

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نفذت تجربتان حقليتان فى منطقه المطريه بالقرب من بحيرة المنزلة بمحافظة الدقهلية خلال الموسمين الشتويين ٢٠٠٩-٢٠١٠ و ٢٠١٠-٢٠١١ لدراسة التأثير المتداخل لمثبتات التأزت المقاومة للملوحة واضافة حامض الهيوميك على تيسير النيتروجين وامتصاص العناصر الغذائيه لمحصول القمح وذلك لتقليل استخدام الأسمدة المعدنيةالتى تؤدى إلى نقص معنوى فى إنتاج محصول القمح.

اشتملت التجربة على ثمانية عشر معاملة فى تصميم قطاعات تحت منشقة وهى تمثل كل التفاعلات الممكنة بين معاملتان من حامض الهيوميك (إضافه هيوميك (٥٠ لتر فدان$^{-1}$) و عدم اضافته) كمعاملات رئيسيه ,وثلاث معاملات من التسميد الحيوى (كنترول، أزوتوباكتر مع أزوسبيريلوم و نوستوك مع انابينا) كمعاملات منشقه و ثلاث معاملات من التسميد النيتروجينى (كنترول، ٤٠ كجم نيتروجين فدان$^{-1}$ و ٨٠ كجم نيتروجين فدان$^{-1}$) كمعاملات تحت منشقه. جميع المعاملات كررت ثلاث مرات ليصبح العدد النهائى للمعاملات ٥٤ معاملة.

أظهرت نتائج البحث أنه بإضافه حامض الهيوميك وجد أن قيم متوسطات كل من عدد الحبوب السنبلة$^{-1}$، طول السنبلة (سم)، وزن ١٠٠٠ حبة، محصول الحبوب (أردب فدان$^{-1}$)، محصول القش (طن فدان$^{-1}$)، النيتروجين ، الفوسفور والبوتاسيوم الممتص فى الحبوب ، القش ، النبات ككل (كجم فدان$^{-1}$) بمرحلة الحصاد حدث بها زيادة معنوية نتيجة لإضافه الهيوميك بمعدل ٥٠ لتر فدان$^{-1}$.

فى هذه الدراسة وجد أن إضافه الأزوتوباكتر مع الأزوسبيريلوم كمعدل للتسميد الحيوى كان الأكثر فعالية فى زيادة كل من قيم متوسطات كل من عدد الحبوب السنبلة$^{-1}$، طول السنبلة (سم)، وزن ١٠٠٠ حبه، محصول الحبوب (أردب فدان$^{-1}$)، محصول القش (طن فدان$^{-1}$)، النيتروجين ، الفوسفور والبوتاسيوم الممتص فى الحبوب ، القش ، النبات ككل (كجم فدان$^{-1}$) بمرحله الحصاد أعلى من أى إضافه للتسميد بمثبتات التأزت المقاومة للملوحة الأخرى وهذا التأثير كان معنوياً خلال موسمى النمو.

اما بالنسبة لتأثير التسميد النيتروجينى فوجد أن متوسطات كل من عدد الحبوب السنبلة$^{-1}$، طول السنبلة (سم)، وزن ١٠٠٠ حبة، محصول الحبوب (أردب فدان$^{-1}$)، محصول القش (طن فدان$^{-1}$)، النيتروجين ، الفوسفور والبوتاسيوم الممتص فى الحبوب ،

القش ، النبات ككل (كجم فدان-١) بمرحلة الحصاد لنبات القمح المعامل بـ ٨٠ كجم نيتروجين فدان-١ أدى إلى حدوث زيادة معنوية مقارنة بالنباتات الغير المعاملة.

وجد أيضاً أن التأثير المتداخل بين المعاملات تحت الدراسة أدت لحدوث زيادة فى قيم متوسطات كل من عدد الحبوب السنبلة-١، طول السنبلة (سم)، وزن ١٠٠٠ حبة، محصول الحبوب (أردب فدان-١)، محصول القش (طن فدان-١)، النيتروجين ، الفوسفور والبوتاسيوم الممتص فى الحبوب ، القش ، النبات ككل بمرحلة الحصاد عند إضافه ٤٠ كجم نيتروجين فدان-١ تحت التسميد بالأزوتوباكتر والازوسبيريلوم فى وجود حامض الهيوميك.

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