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RESPONSE OF WHEAT TO MINERAL AND BIO N - FERTILIZATION UNDER SALINE CONDITIONS

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ABSTRACT: A field experiment was conducted to study the effect of utilizing different nitrogen rates with or without adding ceriallien as a bio- N fixation for increasing and enhancing the nitrogen fertilization efficiency as well as growth and chemical composition of wheat plants grown on a salt affected soil irrigated with saline water of El-Salam canal. The obtained results could be summarized as follows:

1) Dry weights of straw and grains were significantly increased as a result of applied different nitrogen rates and ceriallien. The corresponding highest values were (938 and719 kg fed^{-1} respectively) at the applied treatment of (75 kg N fed.$^{-1}$ + ceriallien).
2) Uptake of N,P&K by wheat plants was significantly affected by the addition of different nitrogen rates and ceriallien. The highest values were obtained due to the addition treatment of (75 kg N fed. $^{-1}$ + ceriallien).
3) Uptake of Fe, Mn, Zn and Pb were clearly affected due to the addition of nitrogen rates and ceriallien, the highest values of Fe, Mn, Zn and Pb were observed due to the applied treatment of (75 kg N fed.$^{-1}$ + ceriallien). While the highest B-uptake was obtained due to the applied treatment of (100 kg N fed.$^{-1}$).
4) Soil available N, P and K were increased due to application of different N-rates and ceriallien relative to the control. The corresponding highest N, P and K values were75.0 and 9.7 and 575 mg kg^{-1} soil, respectively and recorded under application of (75 kg N fed. $^{-1}$ +ceriallien).
5) Highest values of Fe, Mn, Zn and B (7.3, 5.1 , 2.1 and 0.9 mg kg^{-1} soil, respectively) were obtained due to application of (75 kg N fed.$^{-1}$ +ceriallien).

6) Soil pH and soil EC were decreased due to application of different nitrogen rates and ceriallien as comparing to the control. The lowest soil pH and EC values (7.98 and 9.7 dS m^{-1}, respectively) were obtained under application treatment (75 kg N $fed.^{-1}$ +ceriallien).

Key words: Saline Soil, El-Salam Canal irrigation water, mineral and bio-N fertilization.

INTRODUCTION

Wheat is considered the most important cereal crop in Egypt, where The population in Egypt consumes about 5.0 million ton of wheat per year. The area of cultivated land with wheat is 1,380,612 feddan, which produced about 2,180,000 ardabs, (Mostafa, 2003). This production of wheat produces only about 30% of domestic needs. To overcome this problem , attention has been paid to improve the quantity and quality of total production through improving the soil properties and good management of soil fertilization. Nitrogen is one of the major nutrients for various plants, especially wheat and other cereals as sake of producing the economic yields. Its essential role may be attributed to one or all of these reasons: 1) N is constituent of all proteins and nucleic acids and hence of all protoplasm (Russell, 1973), 2) N enhanced the meristematic activities consequently, increasing the cell size that manifested in internodes elongation, (Sabry *et al.,* 1999 and Osman *et al.,* 2000) and 3) N increases the nutrients uptake, capacity of photosynthesis assimilation in building metabolites, its translocation and accumulation in the sink (El-Masry, 2001 and Fathi *et al.,* 2003).

Much interest if focused on dinitrogen fixing systems in soil to improve plant growth and conesquently straw and grains yield of many graminious plants. Biofertilization with N_2- fixers gave appreciable increases in grain and straw yields of different cereal and legumes crops (Fares, Clair and Khalil, 2003). Cerealine is a biofertilizer product in catchall 300 gm / fed mixed with seeds, including *Azospirillium braselence* and *Azotobacter chroccocum* strains, it was recommended by Ministry of Agriculture as biofertilizer to grain , sugar and oil crops. Abd El-Hameed (2002) noted that wheat plant height , spike length, grain No/spike, spikelet No./spike and grain weight/ spike, 1000 grain weight showed positive gradual responses to inoculation with ceriallien.

El- Salam canal is one of the national promising projects involves the reuse of drainage water after reducing its salinity levels by mixing the Nile water with Bahr Hadoos drain (1.095 milliard m^3) and El-Seraw drain (0.435 milliard m^3) which are considered the main source for the drainage water, while the fresh Nile water is about 2.11 milliard m^3 (DRI, 1993). The promising areas that should be irrigated with El- Salam about 620.000 feddan (Ministry of Public Works and Water Resources, 1998). Sources of good quality water to irrigate the present cultivated soils as well as the newly reclaimed areas for increasing crops productivity are limited. Thus, there is an urgent need to use the possible low quality water such as drainage water. These waters may contain nutrients and organic materials being fertilizer sources (Mostafa, 2001).

The current investigation aimed at assessing the effect of different applied nitrogen rates and bio-fertilizer (ceriallien) on increasing the use nitrogen fertilization efficiency as well as growth and chemical composition of wheat plants grown on a salt affected soil irrigated with saline irrigation water of El-Salam canal and some soil chemical characteristics.

MATERIALS AND METHODS

A field experiment was conducted on a saline clayey soil cultivated with wheat (*Triticium aestivium cv Sakha 69)* at south Port Said, governorate and irrigated with saline water of El-Salam canal (a mixture of Nile water: drainage water) at a 1 : 1 ratio during the growth season of 2005 – 2006. Some physical and chemical properties of the soil used in the current study are shown in Table 1.

The experimental soil was divided into three units, with an area of one feddan for each unit and three replicates. The experimental soil units were subjected to some pre treatments as follows: 1) leveling the soil surface by using laser technique. 2) deep sub-soiling plough. 3) establishment of field drains at a distance of 10 m between each of tow ones and deep of 90 cm at drain beginning, and their drainage water flow towards the main collectors of 2 m in depth , and 4) establishment of an irrigation canal in the middle part of the experimental unit. Nitrogen was added at three rates of 75 kg N fed^{-1} as urea, 100 kg N fed^{-1} as urea and 75 kg N fed^{-1} as urea + ceriallien. Potassium sulphate (49.2 % K_2O) and ordinary superphosphate (15.5 % P_2O_5) were applied basically at rates of 36 kg K_2O $fed.^{-1}$ and 15 kg P_2O_5 fed^{-1}, respectively, to the soil as recommended doses. Creallien (*Azospirillium braselence* and *Azotobacter chroccocum* strains) was added at a rate of 600 g fed^{-1}. Seeds of wheat (Triticum aestivium c.v Sakha 69) were sown, on mid

November, 2005. Plant samples were taken at maturity stage. Dry matter yield (DW) as well as the uptake of N, P, K, Fe, Mn, B, Pb and Zn were measured. Chemical analy-sis was performed on the soil at the elongation stage (60 days after plan-ting) to assess the nutrient statues, soil pH and electrical conductivity (EC). Water samples were taken from irrigation canal at different periods of 0, 30 and 80 days after planting to determine the changes in nutrient contents.

The soil, water and plant analy-ses were performed as follows: Par-ticle size distribution was determined by the pipette method (Piper, 1950) and $CaCO_3$ content was determined by the calcimeter (Black 1965). Soil organic matter was assayed by the methods described by Black (1965). Soil pH was measured using pH meter in soil : water suspension (1 : 2.5) as described by (Jackson, 1965). Electrical conductivity (EC_e) was measured in soil paste extract (Jackson, 1967). Available phosph-orus as well as Fe, Mn, Zn, B, and Pb were determined using Inductively Coupled Plasma (ICP) Spectrometry model 400 as (Soltampour, 1985). Available potassium was determined using Flame Photometer (Soltanpour and Schwab, 1977).

Total N in plant was determined by the Kjeldahl method as described by Chapman and Pratt,(1961). Total potassium content was determined by a flame

Table 1. Some physical and chemical properties of the experimental soil.

Particle size distribution (%)				Texture class	OM (%)	$CaCO_3$ %
C. sand	F. sand	Silt	Clay			
2.7	36.9	17.9	42.5	Clay	2.9	12

Φ pH	EC ($dS\ m^{-1}$)	Cations ($meq\ L^{-1}$)				Anions ($meq\ L^{-1}$)			
		Ca^{+2}	Mg^{+2}	Na^{+1}	K^{+1}	CO_3^{-2}	HCO_3^{-1}	Cl^{-1}	SO_4^{-2}
8.2	19.7	6.3	17.1	175.0	0.7	0.0	4.5	128.0	66.7

Available nutrients ($mg\ kg^{-1}$)							
Macro nutrients			Micro nutrients				
N	P	K	Fe	Mn	Zn	B	Pb
40.7	6.1	487.0	4.9	3.8	1.5	0.5	1.7

Φ (1 : 2.5) soil : water suspension

Photometer according to Jackson (1958). Total phosphorus as well as Fe, Mn, Zn, B, and Pb were determined using Inductively Coupled Plasma (ICP) Spectrometry model 400 as (Soltampour, 1985). Ammonium and nitrate of irrigation water were determined according to the method described by Markus *et al.*, (1982). Statistical analysis of the obtained data was done according to Snedecor and Cochran (1972).

RESULTS AND DISCUSSION

Irrigation Water Properties

Data presented in Tables 2 and 3 show that EC_{iw} values of irrigation water ranged between 1.43 and 2.14 dS m^{-1}. Thus, according to Ayers and Westcot (1985), that water could be considered as slight to moderate (0.70 to 3.00 dSm^{-1}), and causing salinity problems. Also, SAR values of irrigation water during the growth periods of wheat ranged between 4.01 and 4.52, indicate no sodicity problems due to the SAR values were less than 6. Concentration of N, P and K (mg L^{-1}) in irrigation water, their values ranged between 19.4 – 33.5 mg/l for N and it's within the range of slight moderate category according to the guidelines of Ayers and Westcot, (1985); 3.9 – 4.7 mg/l for P and 9.87 – 11.01 mg/l for K during the growth periods. Phosphorus and Potassium in wastewater are not known to cause affects on plants, due to they are of the essential macronutrient for plants and affects positively on soil fertility as well as crop yields and quality. Potassium in irrigation water may be taken into consideration in formulating the fertilization programs according to the irrigated crops, (Shaban, 1989). Concentration of trace and heavy elements were generally low. They were (in μg L^{-1}) 730 – 910 for Fe; 430 – 610 for Mn ; 670 – 730 for Zn ; 42 – 51 for B and 480 – 600 for Pb. In this concern, (Mostafa, 2001) mentioned that the concentration of trace elements and heavy metals in all irrigation waters were generally low. There were (in μg L^{-1}) in Nile water (NW), drainage water (DW) and sewage water (SW) were 422 , 618 and 618 for Fe ; 57.1, 72.9 and 142 for Zn ; 16.5 , 29.3 and 25.6 for Mn ; 176 , 458 and 637 for Pb. These results are in agreement with those obtained by Fawzy (1986) ; El-Tabey (1993) ; El- Sebaey (1995) and Shaban (2005). The concen-tration of Fe, Mn , Zn , B and Pb in

El-Salam canal irrigation water were found within safe or permissible limits and possible using for irrigation.

Effect of Nitrogen Fertilization and Irrigation Water Quality on Nutrient Contents in Soil

Soil (pH) and soil electrical

conductivity (EC)

Data in Table 4 reveal that soil pH was decreased due to the applied of N- treatments as compared to the control one. However, the decrease in soil pH when the nitrogen applied with ceriallien was rather higher than the nitrogen individually. The obtained data show that, lowest value of soil pH under addition of different treatments (7.98) was observed under application of (75 kg N fed.$^{-1}$ + ceriallien). As for soil electrical conductivity (EC), data clear that soil EC gave the same pattern observed for soil pH. This may be due to the salt leaching processes from the soil especially from the uppermost layer (0 – 30 cm) through wheat cultivation period which depended upon the quality & quantity of the irrigation water and the method of water application. Also, regarding to the irrigation water analysis it's clear from the data that irrigation water have elect-

Table 2. Chemical composition of the irrigation water used in the current study

Periods (days) of sampling	pH	EC dSm^{-1}	Cations (meq L^{-1})				Anions (meq L^{-1})				SAR
			Ca^{+2}	Mg^{+2}	Na^{+1}	K^{+1}	CO_3^{-2}	HCO_3^{-1}	Cl^{-1}	SO_4^{-2}	
0	8.21	1.70	3.70	4.30	8.19	0.67	0.00	4.20	6.90	5.76	4.10
35	8.34	2.14	4.80	5.70	10.4	0.52	0.00	5.60	7.50	8.32	4.52
80	8.20	1.43	2.90	3.70	7.30	0.42	0.00	2.40	5.90	6.02	4.01

Table 3. Macro and microelements content in the irrigation water

Periods (days) of sampling	Macro nutrients (mg L^{-1})				Micro nutrients (mg L^{-1})				
	Nitrogen (N)		P	K	Fe	Mn	Zn	B	Pb
	NO_3	NH_4							
0	15.3	8.70	4.70	11.01	0.73	0.43	0.70	0.05	0.51
35	19.70	13.80	3.90	9.87	0.91	0.61	0.73	0.05	0.60
80	11.50	7.90	4.80	10.79	0.75	0.19	0.20	0.04	0.48

Table 4. Soil pH, ECe and available contents of the studied macro and micronutrients as affected by the applied N-treatments

Properties	§ pH	♦ EC (dS m^{-1})	Available nutrients (mg kg^{-1})							
			Macro elements			Micro elements				
			N	P	K	Fe	Mn	Zn	B	Pb
Control	8.26	19.7	40.7	6.1	487	4.9	3.8	1.5	0.75	1.7
75 kg N $fed.^{-1}$	8.20	13.3	52.3	8.3	510	5.6	4.1	1.7	0.84	1.3
100 kg N $fed.^{-1}$	8.15	12.8	61.0	9.2	541	4.9	4.5	1.9	0.68	1.2
75 kg N $fed.^{-1}$ + ceriallien	7.98	9.7	75.0	9.7	575	7.3	5.1	2.1	0.90	0.9

§ Suspension of (1 : 2.5) w / w soil : water ♦ Water extract of (1 : 2.5) w / w soil : water

rical conductivity (EC) ranged between 1.43 – 2.14 dSm^{-1}. Thus, according to Ayers and westcot (1985), that water may be considered of slight to moderate salinity problems (0.70 to 3.00 dSm^{-1}). These findings are in harmony with those obtained Mostafa (2003) who found that increasing nitrogen application rates to 150 kg N fed^{-1} caused highly significant decrease in both EC and ESP values.

Available macronutrients in soil

Data presented in Table 4 indicate that the applied of different N-treatments led to increase available N, P and K contents in soil as compared to the control treatment. Rabie (2003) found that the urea fertilization caused significant increases in the levels of NH_4^+ -N and total mineral (NH_4^+ + NO_3^-) - N in both surface and subsurface soil samples as compared to the control treatment . The treatment of (75 kg N $fed.^{-1}$ + ceriallien) seemed to be generally superior with N and P, which is possibly due to the beneficial role of microorganisms in ceriallien, and their biological activity in particular and help build up the micro flora .

Highest soil available N, P and K contents (75, 9.7and 575 mg kg^{-1} soil respectively) were observed under the combined treatment of (75 kg N fed^{-1} + ceriallien).

Available micronutrients in soil

As shown in Table 4 application of different N-treatments was slightly increased available Fe, Mn, Zn and B contents in soil as compared to the control treatment, while Pb was decreased.

Highest available Fe, Mn and B contents in soil (7.3, 9.1 and 0.9 mg kg $^{-1}$ soil respectively) was obtained under applied treatment of (75 kg N fed.-1 + ceriallien).

Effect of Nitrogen Fertilization and Irrigation Water Quality on Nutrient Contents in Plant

Macronutrients in plant

Data in Table 5 pointed out that application of nitrogen treatments was increased the concentrations of N, P and K uptake by wheat plants as compared to the control treatment . Data also revealed an ascending increases in the order, of (75 kg N fed^{-1} +ceriallien) > (100 kg N fed.$^{-1}$) > (75 kg N fed.$^{-1}$) in all cases.

Inoculation of wheat seeds with N_2 fixers was responsible for the statistically increments in uptake of studied nutrients as compared to the inoculated plants. This promoting effect could be related to the N-supplementary effect of non symbiotic N_2 – fixing bacteria (used as bio- N fertilizer) to plant, due to their ability to fix free molecular atmospheric nitrogen as well as the role of these bacteria for improving the availability of soil elements, through secreting creator substances (such as organic acids) which are important for solubilizing sparingly soluble inorganic compounds to make easy forms available for plants uptake. Moreover, the hormonal exudates (such as indol acetic acid, gibberellins and cytokines) of these micro-organisms can modify root growth (morphology and/or physic-ology) resulting in more efficient absorption of available nutrients from the soil (Noel et al., 1996 and Carietti et al., 1996).

Nitrogen uptake

Nitrogen uptake was increased significantly by the application of different nitrogen rates and ceriallien as compared to the control treatment . Kotb (1998) pointed out that N fertilizers increased the capacity of wheat plants to absorb nutrients. Also, he showed that the rates of applied nitrogenous fertilizer grad-ually increased the means of nitrogen uptake by both straw and grains. Omar *et al.* (1996) conducted a pot experiment to study the nitrogen nutrition of wheat plant *(Triticum aestivium* var. Sakha 69) ,inoculated with *Bacillus polmyxa* in a sandy soil, in presence of 75 mg N Kg $^{-1}$ soil ,they showed that this treatment resulted in an increase in the nitrogen and protein contents up to14 and 15% , respectively. The obtained findings matched well with those of Metwally (2000); Madlain Salib et al., (2002); Mohammed, (2002); Elwan et al., (2001) and

Table 5. Nitrogen , phosphorus and potassium uptake (kg fed $^{-1}$) as affected by applied nitrogen rates and ceriallien

Treatments	N - Uptake (kg fed $^{-1}$)			P - Uptake (kg fed. $^{-1}$)		K - Uptake (kg fed. $^{-1}$)	
	Straw	Grains	Protein %	Straw	Grains	Straw	Grains
75 kg N fed. $^{-1}$	9.33 c	9.91 c	12.2	1.80 c	1.57 c	13.4 c	6.71 c
100 kg N fed. $^{-1}$	12.1 b	15.6 b	12.9	3.41 b	3.51 b	19.4 b	8.20 b
75 kg N fed.$^{-1}$ + ceriallien	13.7 a	16.9 a	13.4	4.13 a	4.46 a	20.8 a	9.82 a
Mean	11.7	14.2	12.8	3.11	3.18	17.86	8.24
L.S.D (0.05)	2.08	2.21		0.30	0.34	0.72	0.48

Abd El-Rasoul *et al.* (2003).

Highest N-uptake of either straw (13.69 kg fed $^{-1}$) orgrains (16.90 kg fed.$^{-1}$) was obtained under applied treatment of (75 kg N fed. $^{-1}$+ ceriallien). Data also reveal that the treat-ment of 75 kg N fed. $^{-1}$ + ceriallien gave the highest level of protein (13.4 %), and it was superior to the other ones of 75 kg N fed. $^{-1}$.

Phosphorus uptake

Phosphorus uptake followed the same trend of N-uptake by wheat plants. Hence, the application of nitrogen rates and ceriallien increa-sed significantly P-uptake. This may be due to the important role of bacteria for releasing P from super-phosphate or other difficult P forms through producing organic and in-organic acids as well as CO_2. In addition, bacteria may produce some growth promoting substances such as ouxine, gibberellins and cytokine-es, which improving plant growth and stimulate the microbial develop-ment (Abd El- Rasoul *et al.*, 2002).

The highest P-uptake by straw and grains (4.13 and 4.46 kg fed $^{-1}$, respectively) was observed under the applied treatment of (75 kg N fed.-1 + ceriallien).

Potassium uptake

Potassium uptake was signify-cantly increased due to application of nitrogen rates and ceriallien as compared to the control treatment. This may be due to the result of improving the micro activities, which will have a contribution in decreasing soil pH and chelating ions, leading to increase available forms of elements in the rhizosphere zone. Consequently, the uniform supply of nutrients to plants could be expected throughout the growth season. El-

Sherbieny *et al.* (1999) stated that increasing the rate of added nitrogen significantly increased total content of nitrogen, phosphorus and potassium of wheat grains. Highest K-uptake of either straw (20.80 kg fed $^{-1}$) or grains (9.82 kg fed $^{-1}$) was obtained under applied treatment of (75 kg N fed^{-1}+ ceriallien).

Micronutrients in plant

Inoculation of wheat seeds with N_2 fixers was responsible for the statistically increments in uptake of studied nutrients as compared to the inoculated plants. This promoting effect could be related to the N- supplementary effect of non symbiotic N_2 – fixing bacteria (used as bio- N fertilizer) to plant due to their ability to fix free molecular atmospheric nitrogen as well as the role of these bacteria in improving the availability of soil elements, through secreting creator substances (such as organic acids) which are important for solubilizing sparingly soluble inorganic compounds to make easily forms available for plants uptake. Moreover, the hormonal exudates(such as indol acetic acid, gibberellins and cytokines) of these micro-organisms can modify root growth (morphology and / or physicology) resulting in more efficient absorption of available nutrients from the soil (Noel et al., 1996 and - Carietti et al., 1996).

As shown in Table 6 application of nitrogen rates and ceriallien were significantly increased Fe and Mn - uptake of wheat as compared to the control treatment. In this respect, a pot experiment was conducted to study the nutrient uptake and dry matter yield of barley as affected by salinity of irrigation water and addition of organic materials by Mostafa, (2001). He found that, the addition of organic materials i.e. Poultry manure and Olive cake residues were increased the uptake and concentration of Fe , Mn , Zn and Cu. El-Naggar, (1999) stated that application of slow release N fertilizer (Ureaformaldehyde coated urea) for wheat plants increases micronutrient concentration and uptake by wheat at all doses of N used. These results are in agreement with those obtained by Awad *et al.*, (1990) ; El-Koumy (1998) ; Faiyad (1999) and Awad *et al.*, (2000) .

The greatest Fe and Mn uptake of straw (164.2 and 73.2 g fed^{-1}, respectively) as well as grains (156.0 and 79.0 g fed $^{-1}$) were observed due to the addition of (75 kg N fed.$^{-1}$ + ceriallien) .

As shown in Table 7 highest Zn and Pb uptake (91.0 and 10.3g fed $^{-1}$, respectively) for straw and (71.9 and 12.2 g fed $^{-1}$, respectively) for grain were observed due to the addition of treatment (75 kg N fed.$^{-1}$ + ceriallien). While highest B uptake of straw and grains (8.8 and 9.6 g fed $^{-1}$, respectively) were obtained under the treatment of 100 kg N fed. $^{-1}$. These increases may be attributed to the role of microorganisms for improving these micronutrients avai-lability, which was likely attributed to several reasons: 1) Releasing of these nutrients through microbial decomposition of organic matter in soil ; 2) Reducing the pH of the soil making the nutrients more available; and 3) Lowering the redox statues of iron and manganese, leading to reduction of higher Fe^{3+} & Mn^{4+} to Fe^{2+} and Mn^{2+} and / or transform-ation of insoluble chelated forms into more soluble ions (Castilho *et al.*, ,1993).

Effect of Nitrogen Fertilization and Irrigation Water Quality on Biological Yield of Wheat and Yield Efficiency

Biological yield content

Data shown in Table 8 reveal that dry matter yields of straw and grains were increased due to utilization of nitrogen rates and ceriallien. This may be attributed to the role of N for increasing the wheat yield and its mineral composition has been well documented as it is required for the synthesis of proteins, protoplasm formation and its transferring to cell wall that manifested in enhancing the meristematic activities and increasing the cell size, leaf expansion and inter node elongation. As a result higher yields and better nutritive contents for wheat plants could be expected, Nassar et al., (2004) In this regard, Salem, et al. (2004) reported that straw weight, number of spikes/m^2, number of spikes / spike, grain weight, 1000 grain weight and grain (ardab) were significantly increased as the addition of N fertilization . These results are in agreement with Osman et al., 2000.; El-Masry , 2001. ; Abd El-Maksoud, 2002. and Fathi et al., 2003.

Table 6. Iron and manganese uptake (g fed. $^{-1}$) of wheat as affected by nitrogen rates and ceriallien addition

Treatments	Fe - Uptake (g fed. $^{-1}$)		Mn - Uptake (g fed. $^{-1}$)	
	Straw	Grains	Straw	Grains
75 kg N fed. $^{-1}$	99.3 c	71.3 c	33.1 c	40.1 c
100 kg N fed. $^{-1}$	129.5 b	144.7 b	56.0 b	61.1 b
75 kg N fed.$^{-1}$ + ceriallien	164.2 a	156.0 a	73.2 a	79.0 a
Mean	131.0	124.0	54.1	59.73
L.S.D. (0.05)	1.85	2.82	2.64	2.90

Table 7. Zinc, boron and lead uptake (mg fed. $^{-1}$) of wheat as affected by nitrogen rates and ceriallien addition

Treatments	Zn - Uptake (g fed. $^{-1}$)		B - Uptake (g fed. $^{-1}$)		Pb - Uptake (g fed. $^{-1}$)	
	Straw	Grains	Straw	Grains	Straw	Grains
75 kg N fed. $^{-1}$	45.9 c	36.1 c	6.0 c	5.1 b	5.3 b	4.6 c
100 kg N fed. $^{-1}$	60.4 b	55.8 b	11.3 ab	11.5 a	7.0 b	7.6 b
75 kg N fed.$^{-1}$ + ceriallien	91.0 a	71.9 a	8.8 b	9.6 a	10.3 a	12.2 a
Mean	65.8	54.6	8.7	8.7	7.5	8.1
L.S.D. (0.05)	3.18	3.38	3.40	2.54	2.42	2.16

Table 8. Dry matter yield and yield efficiency (%) of wheat plants as affected by nitrogen rates and ceriallien addition

Treatments	Dry matter yield (ton fed $^{-1}$)			Φ yield efficiency %
	Straw	Grains	Whole plant	
75 kg N fed. $^{-1}$	0.752 c	0.463 c	1.215	38.1
100 kg N fed. $^{-1}$	0.875 b	0.689 b	1.564	44.1
75 kg N fed.$^{-1}$ + ceriallien	0.938 a	0.719 a	1.657	43.4
Mean	0.855	0.623	1.479	41.9
L.S.D. (0.05)	25.74	29.41		

Φ Yield efficiency = { yield of grains / (yield of straw + grains)} X 100

Highest straw and grains yield were observed under the addition of (75 kg N fed.$^{-1}$ +ceriallien). Highest values were (938 and 719 kg fed. $^{-1}$, respectively). The favorable effect of mineral N-fertilization with its increased rates on the light of the fact that nitrogen is essential nutrient for plant growth and it is one of the most important constituents of all proteins and nucleic acids, and hence of all protoplasm and chlorophyll . As the level of N- supply increases, the extra protein produced allows the plant leaves to grow larger and consequently available for photosynthesis proportional to the rise of N-supplied; therefore, the increase in N-fertilization level led to an increase in metabolic processes and physiological activities necessary for more plant organs formation, more dry matter accumulation and enhancing the grain hilling rate, which finally increase the amount of protein in grain. Thus more crop yield with good quality of grains. Also, the effect of N-availability at critical stages of spike initiation and development on plant metabolism in way leading to increase synthesis of amino acids and their incorporation in grain protein could be behind the increase of protein content due to increasing the applied rate of N-fertilizer. (Russel, 1973 and Kotb, 1998). In this respect, Mohammed (2002) stated that amending the soil either with natured town refuse or sewage sludge compost manure were shown to be highly significant increased the dry matter weight as well as straw and grains yield.

Yield efficiency

Yield efficiency of plants treated with 100 kg N fed^{-1} was the highest. The values were 38.1 %, 44.1% and 43.4 % under the treatments of 31.5 kg N ha^{-1}, 45 kg N ha^{-1} and 31.5 kg N ha^{-1} + ceriallien, respectively.

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استجابة القمح للتسميد النيتروجينى المعدني و الحيوي تحت الظروف الملحية

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أجريت تجربة حقلية بمنطقة جنوب محافظة بورسعيد لدراسة تأثير استخدام معدلات مختلفة من التسميد النيتروجينى في وجود أو عدم وجود السيريالين كسماد حيوي على محصول المادة الجافة لنباتات القمح وامتصاصها لبعض العناصر الكبرى و الصغرى كما اشتملت الدراسة على استبيان هذا التأثير على بعض الخواص الكيميائية للتربة تحت الدراسة بعد الحصاد و ذلك تحت تأثير استخدام مياة ترعة السلام كمصدر للري. ويمكن تلخيص أهم النتائج المتحصل عليها كما يأتي:

١) ازداد محصول المادة الجافة للقش و الحبوب لنبات القمح معنويا بإضافة المعاملات المختلفة للتسميد النيتروجينى وكانت أعلى قيم من القش و الحبوب هي (٩٣٨ ، ٧١٩ كجم / فدان) على التوالي تم التحصل عليها نتيجة معاملة الإضافة (٧٥ كجم ن / فدان + السريالين).

٢) أزداد امتصاص النيتروجين و الفسفور و البوتاسيوم معنويا بواسطة نبات القمح نتيجة لإضافة المعاملات النيتروجينية المختلفة و السريالين وكانت أعلى القيم قد تم التحصل عليها نتيجة معاملة الإضافة (٧٥ كجم ن /فدان + السريالين).

٣) أزداد امتصاص الحديد و المنجنيز و الزنك و الرصاص و البورون معنويا بواسطة نبات القمح نتيجة لإضافة المعاملات النيتروجينية المختلفة و السريالين وكانت أعلى قيم للحديد و المنجنيز و الزنك و الرصاص تم التحصل عليها نتيجة معاملة الإضافة (٧٥ كجم ن /فدان + السريالين) بينما كانت أعلى قيمة للبورون قد تم التحصل عليها نتيجة معاملة الإضافة (١٠٠ كجم ن / فدان).

٤) ازدادت قيم النيتروجين و الفسفور و البوتاسيوم الميسرة بالتربة نتيجة لإضافة المعاملات النيتروجينية المختلفة و السريالين وكانت أعلى قيم للنيتروجين و الفسفور و البوتاسيوم (٧٥,٠ و ٩,٧ و ٥٧٥ ملليجرام / كجم تربة على التوالي) قد تم التحصل عليها نتيجة معاملة الإضافة (٧٥ كجم ن /فدان + السريالين).

٥) أعلى قيم للحديد و المنجنيز و الزنك و البورون الميسرة (٧,٣ ، ٥,١ ، ٢,١ , ٠,٩٠ ملليجرام / كجم تربة على التوالي) تم التحصل عليها نتيجة معاملة الإضافة (٧٥ كجم ن /فدان + السريالين) .

٦) انخفضت قيم رقم pH التربة و كذلك درجة التوصيل الكهربي نتيجة لإضافة المعاملات النيتروجينية المختلفة و السريالين مقارنة بالكنترول نتيجة معاملة الإضافة (٧٥ كجم ن /فدان + السريالين).