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POTASSIUM FERTILIZION AND SOIL AMENDMENTS INTERACTIONS AND THEIR EFFECTS ON WHEAT IRRIGATED WITH DIFFERENT WATER QUALITIES

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ABSTRACT

A field experiment was conducted in 2002/2003 season at the farm of El-Serw experimental station (ARC), Domiatta governorate, Egypt. This study aims to assessment the effect of potassium fertilization (0, 24 and 48 Kg K_2O/fed) and soil amendments (Gypsum at rate of 6 ton/fed, FYM at rate of 20m^3 /fed. and Gypsum + FYM) on wheat plants irrigated with Nile and drainage water. The obtained data revealed that:

- Wheat grains yield; 1000 grains weight and straw yield significantly decreased under irrigation with drainage water, but increasing the dose of K-fertilizer significantly increased them.

  On the other hand, application the amendments of Gypsum (at rate 6 ton/fed) or FYM (at rate 20 m^3 /fed) either solo or in a mixture of Gypsum (6 ton/fed) + FYM (20 m^3 /fed) gave significant increments in the yield components compared with the control (no-amendment). In general, the mixture of Gypsum + FYM was the more beneficial treatment on yield components, and was distinct under irrigation with Nile water.
- Irrigation with Nile water was more effective on increasing N, P and K uptake (kg/fed) by grains and straw of wheat than the irrigation with drainage water. While non-significant differences were noticed between the irrigation with the two types of waters on N%, P% and K% of wheat straw.

  Increasing the dose of potassium fertilizer, in general, significantly increased N%, P%, K% and their uptake (kg/fed.) by grains and straw of wheat comparing with the control treatment (K0) under the conditions of irrigation with Nile or irrigation with drainage water.

  N, P, and K (percent) or (kg/fed.) of wheat grains and straw tended to increase significantly because of treating the soil with any of gypsum or FYM, a mixture of gypsum + FYM in comparing with the un-treating soil (control) under the conditions of irrigation with Nile or with drainage water. The superiority in these increments was noticed for the treatment of (gypsum + FYM) followed, in general, with the treatment of FYM, then the treatment of gypsum.

INTRODUCTION

Increasing the productivity of crops in most Egyptian soils represent the greatest hope and national goal in solving the shortage in food production and in facing the various needs of fast expanding populations.

For sharing in solving the problem of shortage in food production, the most possible processors of: irrigation crops with different water qualities; treating soils with sundry natural or chemical amendments as well as increasing the dose of applied mineral fertilizers were evaluated through the researches of many scientists. Generally, they reported that the use of some of these processors in combination form had given better effects on the soil properties and on the yield of growing plants than their use individually.

Therefore, it was necessary for resisting the hazards effects of irrigation with low water qualities, which use for facing the shortage of fresh water, to use of some of soil amendments. In this concern, many investigations showed that the application of different organic manures, gypsum and sulphur in a single-handed form or in combination form protected the soils from the risks of salinity, then insured better conditions for plants to grow well (El-Maghraby *et al.* , 1996 and El-Maghraby1997).

On the other hand, potassium is an essential element for plant growth not only in regard to its concentration in plant tissues but also to its physiological and biochemical functions which help plants grow in saline conditions to tolerate salinity (NIAB, 1982 and Ibrahium *et al.*, 2002). In addition, potassium may be expected to improve the efficiency of N and P fertilizers (Kelarestghi and Bahbahanizaden, 1994). In addition, Negm *et al.* , 2002 stated that treated maize plants with FYM manure as well as potassium fertilizers were significantly effective in increasing their yield and their nutrients uptake than those plants that received K- fertilized alone.

The purpose of this current research is to study the response of wheat plants to treated soil with potassium fertilizer, gypsum and FYM under the conditions of irrigation with Nile water or drainage water.

MATERIALS AND METHODS

This investigation work was conducted at the farm of the experimental station of El- Serw (ARC), Domiatta governorate, Egypt. The main characteristic estimations of the soil as well as the used irrigation waters and farmyard manure (FYM) were carried out according to Black (1965) and shown in Tables (1-3).

The experiment was laid out in a two split–plot design with the area of 21m٢for the experimental plot, while all the experimental treatments were replicated three times. The two main-plots were irrigated with Nile water or drainage water. Three rates of K_2SO_4 fertilizers, i.e. zero K_2O/fed. (K0), 24 K_2O/fed. (K1) and 48 K_2O/fed. (K2) were applied as sub main-split treatments. The sub main split-plots were divided into four sub sub main split-plots and each of them was treated (before sowing of wheat) with one amendment of:

- No amendment (control).
- Gypsum (6 ton/fed).
- Farmyard manure (FYM) at the rate of 20 m^3 /fed.
- Gypsum (6 ton/fed) + FYM (20 m^3 /fed).

Table 1: Some characteristics of the experimental soil under the conditions of irrigation with different water qualities.

Sources of Irrigation water	Organic matter (%)	pH (Soil paste)	EC, dS/m (Soil paste)	Particle size distribution (%)					Soil available nutrients (ppm)		
				Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)	Texture Class	N	P	K
Nile	2.71	7.90	2.27	0.57	21.38	16.10	58.95	Clay	5.39	4.70	95.77
Drainage	4.96	7.80	2.79	0.44	12.00	18.26	68.40	Clay	2.62	3.90	104.60

All the experimental plots were received the recommended doses of nitrogen (100 Kg N/fed. as ammonium sulphate, 20.5% N) and phosphorus (30 Kg P_2O_5/fed. as super phosphate, 15.5% P_2O_5). Wheat grains (*Triticum aestivum L.*, Giza 168 variety) had been sown in 25/11/2002.

At harvesting, wheat grains and straw yields as well as the weight of 1000 grains were recorded. Samples of grains and straw were oven dried at 70 C° until constant weight and ground for chemical analysis. 0.2g plant samples were digested in a mixture of $HClO_4$ and H_2SO_4 acids according to the procedure of Chapman and Pratt (1961). Total nitrogen, phosphorus and potassium in the digested grain and straw solutions were determent by the distillation in a macro-kjeldahl apparatus (Jackson, 1973), by ascorbic acid method Hergert (1970) and by Flame photometer (Ryan *et al.* , 1996), respectively.

The obtained data were exposed to proper statistical analysis of variance (ANOVA) by using the Minitab program (Barbara and Brain, 1994), and then the least significant differences (LSD, at 5%) were calculated.

Table 2 Some chemical properties of irrigation waters.

Chemical characteristics	Sources of irrigation water	
	Nile water	Drainage water
EC, dS/m at 25 C°	0.69	2.34
Cations:(meq/l)		
Ca^{++}	2.83	3.43
Mg^{++}	1.69	5.11
Na^{+}	3.23	17.99
K^{+}	0.24	0.39
Anions: (meq/l)		
$CO_3^{=}$	0.32	1.04
HCO_3^{-}	3.23	3.53
Cl^{-}	2.40	17.69
$SO_4^{=}$	2.04	4.67
N (ppm)	0.66	0.70
P (ppm)	0.59	0.78
Fe (ppm)	0.50	0.١٩
Mn (ppm)	0.٢٧	0.٣٢
Zn (ppm)	0.٠٥	0.٠٣

Table 3 Main characteristics of the used Farmyard manure (FYM).

O.M.%	O.C.%	C/N	Total elementals (%)		
			N	P	K
10.50	5.89	23.68	1.50	0.29	3.76

RESULTS AND DISCUSSION

The yield components of wheat:

The values of wheat grains yield, 1000 grains weight and straw yield were used to express the yield components.

Effect of irrigation water quality:

The yield components of wheat were shown in Table 4. These data show that all the parameters of the yield components significantly were decreased because of irrigation with drainage water. The relative decrement percent of grains yield, 1000 grains weight and straw yield were 21%, 2% and 16%, respectively. The decreasing in yield components was attributed to increasing both soluble salt contents and osmotic pressure of the soil solution due to increasing EC of drainage water, which exceeded ≈ 3 times more than EC of Nile water (Table 2). The less water flow from the soil into the plant will be occurred which negatively reflected on physiological processes, metabolic activities and growth of plants (Bayoumi *et al.*, 1997).

The role of potassium fertilization:

As shown in Tables 4 and 5, increasing the dose of K-fertilizer significantly increased the yield components of wheat. Whereas, the values of (I.P,%) for wheat grains yield, 1000 grains weight and straw yield increased with increasing the dose of K-fertilizer. The (I.P,%) values were more pronounced in soils irrigated with drainage water than those irrigated with Nile water. This trend based on that increasing the dose of K-fertilization enhanced K-uptake by the plants grown under saline conditions. This will lead to decreasing Na uptake by those plants and then decreasing (Na/K) ratio inside them, which reflected on the improvement of growth and yield of these plants (NIAB, 1982). In general, these results could be explained by the findings of Bringeer (1980) who stated that increasing wheat grain yield as a result of increasing K-fertilizer dose was parallel by a greater area of flag-leaf, being a major source of assimilates for the developing grains. Additionally, the leaves had higher chlorophyll contents and succulence at harvest indicating that, the high K-application treatments were less senescent. Grain yield increase could, therefore, be due to higher photosynthesis. He added that the potassium nutrition increased the grain weight and the number of grains/ear.

The role of soil amendments:

As reported in Table 4, the application of Gypsum (at rate 6 ton/fed), FYM (at rate 20 m^3 /fed) either single or in a mixture of Gypsum (6 ton/fed) + FYM (20 m^3 /fed) gave significant increments in all the yield components compared with the control (no-amendment), under all the other experimental treatments.

Table 4: Yield components and nutrients contents of grains & straw of wheat plants as affected by different experimental treatments.

Experimental treatments			Yield components			Nutrients content of grains (%)			Nutrients content of straw (%)		
Types of Irrigation water	Potassium fertilization (Kg/fed.)	Amendments	Grain (Ardab/fed) *	1000 grains weight (gm)	Straw (Ton/fed.)	N	P	K	N	P	K
Nile Water	K (0) (0 Kg. K_2O_4)	Control	10.157	34.827	2.540	1.200	0.306	0.322	0.202	0.263	1.156
		Gyps	11.057	35.227	2.646	1.217	0.310	0.371	0.212	0.270	1.162
		FYM	11.280	35.273	2.593	1.337	0.321	0.347	0.231	0.299	1.163
		Gyps+FYM	12.633	35.663	2.663	1.460	0.323	0.363	0.233	0.311	1.168
	K (1) (24 Kg .K_2SO_4)	Control	10.907	35.437	2.717	1.246	0.312	0.361	0.214	0.272	1.172
		Gyps	11.827	35.303	2.793	1.357	0.311	0.432	0.223	0.274	1.205
		FYM	12.143	38.907	2.870	1.437	0.331	0.413	0.233	0.320	1.211
		Gyps+FYM	13.480	40.003	3.050	1.530	0.330	0.436	0.237	0.324	1.213
	K (2) (48 Kg .K_2SO_4)	Control	11.360	35.943	2.650	1.300	0.315	0.370	0.231	0.282	1.202
		Gyps	12.387	37.617	2.850	1.327	0.324	0.440	0.222	0.286	1.220
		FYM	12.513	40.843	2.997	1.493	0.343	0.433	0.237	0.332	1.223
		Gyps+FYM	13.880	46.050	3.220	1.540	0.335	0.443	0.242	0.334	1.224
Drainage Water	K (0) (0 Kg. K_2O_4)	Control	8.180	34.140	1.960	1.283	0.303	0.346	0.203	0.264	1.163
		Gyps	8.500	34.663	2.040	1.397	0.321	0.370	0.222	0.274	1.176
		FYM	8.813	35.063	2.200	1.353	0.324	0.335	0.231	0.312	1.182
		Gyps+FYM	9.453	35.327	2.267	1.477	0.335	0.372	0.234	0.325	1.184
	K (1) (24 Kg. K_2SO_4)	Control	8.737	35.000	2.057	1.243	0.312	0.388	0.221	0.274	1.211
		Gyps	9.203	35.457	2.173	1.247	0.325	0.431	0.221	0.276	1.212
		FYM	9.820	38.077	2.483	1.347	0.331	0.414	0.236	0.313	1.215
		Gyps+FYM	10.380	40.150	2.880	1.510	0.327	0.442	0.240	0.322	1.220
	K (2) (48 Kg. K_2SO_4)	Control	9.203	35.643	2.117	1.343	0.316	0.397	0.232	0.270	1.142
		Gyps	9.607	36.110	2.280	1.320	0.327	0.436	0.222	0.285	1.222
		FYM	10.050	40.760	2.590	1.477	0.344	0.424	0.235	0.319	1.226
		Gyps+FYM	11.177	43.367	3.030	1.520	0.332	0.443	0.241	0.333	1.222

* (Ardab of wheat grains = 150 kg.)

L.S.D (5%):									
Irrigation (I)	0.068	0.079	0.023	n.s	0.001	0.002	n.s	n.s	n.s
K.fertilizrers (K)	0.083	0.097	0.028	0.003	0.002	0.003	0.001	0.002	0.013
Amendments (Am)	0.096	0.112	0.032	0.004	0.002	0.003	0.002	0.002	0.015
I x K x Am	0.235	0.275	0.078	0.009	0.005	n.s	0.004	0.005	n.s

Table 5: Increment Percent (I.P,%) in yield components as affected by increasing k- fertilizer dose and different amendments under irrigation with different waters.

Types of Irrigation water	Treatments	Increment Percent (%)		
		Grains yield	1000 grains weight	Straw yield
Nile Water	K (0)	*0.00*	*0.00*	*0.00*
	K (1)	7.15	6.14	9.46
	K (2)	11.11	13.80	12.18
Drainage Water	K (0)	*0.00*	*0.00*	*0.00*
	K (1)	9.12	6.82	11.95
	K (2)	14.56	11.99	16.90
Nile Water	Control	*0.00*	*0.00*	*0.00*
	Gyps	8.78	1.83	2.27
	FYM	10.83	8.30	6.82
	Gyps+FYM	23.34	14.60	12.88
Drainage Water	Control	*0.00*	*0.00*	*0.00*
	Gyps	4.55	1.38	5.88
	FYM	9.81	8.70	18.63
	Gyps+FYM	18.72	13.42	33.82

On the other hand, as shown in Table 5 the highest increments (%)in wheat grains yield and 1000 grains weight, due to application of the amendments, were more pronounced under irrigation with Nile water. While the contrary trend was noticed in straw yield, whereas the highest increment % in their values were noticed under irrigation with drainage water. In general, the mixture of Gypsum + FYM was the more beneficial treatment, whereas it gave higher I.P %; in all the components of yield; than the two others amendments which added in solo form. The effects of the Gypsum + FYM mixture was possibly due to their beneficial effects on the physicochemical properties affecting plant growth, *e.g.* soil structure, available water, soil salinity and acidity as well as the availability of nutrients in soil, thereby wheat plants will have a favorable environmental conditions with low salt and moisture stress to grow better (El-Maghraby, 1997). The positive roles of amendments added solo or in combination on plants grown under saline conditions were researched by El-Maghraby *et al.* (1996).

Nutrients content of wheat grains and straw:

Effect of irrigation water quality:

Data presented in Table 4 showed that irrigation of wheat plants with Nile or Drainage water did not significantly affected on N% of grains. while P% and K% of wheat grains were significantly increased as a result of irrigation with drainage water. On the other hand, non-significant differences were noticed between the irrigation with the two types of waters on N%, P% and K% of wheat straw. These results could be enhanced by those obtained by Bayoumi *et al.*, 1997.

Nevertheless, the mean values of N, P and K uptake by wheat grains were 24,6 and 5.78 and 7.08 (kg/fed) respectively under irrigation with Nile water, and the identical values under irrigation with drainage water were 19.35, 4.59 and 5.66(kg/fed). As for the mean values of nutrient uptake by wheat straw, were 6.23, 8.33 and 33.05 (kglfed) under the conditions of irrigation with Nile water and 5.34, 6.95 and 28.02 (kg/fed) under irrigation with drainage water for N, P and K, respectively. The abovementioned values indicated that the irrigation with Nile water had being more effective on increasing the uptake of nitrogen, phosphorus and potassium by grains and straw of wheat than the irrigation with drainage water.

The depressive responses in nitrogen status for salinity had been observed by Gawish *et al.* , 1999 who suggested that such reduction may be due to disturbance in water absorbed and the decreased in root permeability. Other possibility may be due to high Cl^- in nutrient media, which restrict nitrate uptake (Jones and Hashim, 1991). In addition, Chaudhary et al., 1974 mentioned that decreases in P-uptake by wheat plants with increasing salinity might be due to the reduction in roots growth, which are reflected on reduction in the surfaces area of roots contacted with P. Other possibility is a competitive effect of Cl^- as suggested by Papadopoulos and Rending (1983). Also, the high level of salinity might causes P precipitation and consequently reduces P- availability to plants (Papadopoulos *et al.*, 1985). On the other hand, decreasing K-uptake due to irrigation with saline water, contain Na^+ ion as a dominant cation, could be attributed to the competitive effect of Na^+ ion (NIAB, 1982).

The role of potassium fertilization:

Regarding the effect of potassium fertilization, the data presented in Tables 4 and 6 show, in general, that N%, P%, K% and their uptake (kg/fed.) by grains and straw of wheat were significantly increased with increasing the dose of potassium fertilizer comparing with the control treatment (K0) under the conditions of irrigation with Nile or Drainage water. On the other hand, data in Table 6 reveal that increasing the doses of potassium fertilization were more beneficial in enhancing P and K uptake by grains as well as N and K uptake by straw of wheat plants irrigated with drainage water, whereas their I.P (%) values were higher under the conditions of irrigation with drainage than their corresponding values under irrigation with Nile water. This may be due to the physiological and biochemical functions of K, which help the plants to grow well under normal conditions or under saline stress, and hence could be able to absorb more nutrients from soil (Ibrahim *et al.* , 1986). Also, (Dahdoh, 1997) reported that the application of K increased N, P and K concentrations in wheat.

The role of soil amendments:

As shown in Tables 4 and 6 N, P, and K (percent) and (kg/fed.) of wheat grains and straw were, in general, significantly increased because of treating the soil with any of gypsum or FYM or a mixture of gypsum + FYM in comparing with the un-treated soil (control) under the conditions of irrigation with Nile or with drainage water.The superiority in these increments was noticed in the soil treated with (gypsum + FYM) followed, in general, with soils treated with FYM and those treated with gypsum.

Table 6: Mean values of N, P and K uptake (kg/fed.) by grains and straw of wheat and their increment percent (I.P,%) as affected by increasing K-fertilizer dose and different amendments under irrigation with different waters.

Types of Irrigation water	Treatments	Wheat Grains						Wheat Straw					
		N		P		K		N		P		K	
		Uptake (k g/fed)	I.P (%)	Uptake (k g/fed)	I.P(%)	Uptake (k g/fed)	I.P (%)	Uptake (k g/fed)	I.P (%)	Uptake (k g/fed)	I.P (%)	Uptake (k g/fed)	I.P (%)
Nile Water	K (0)	22.07	*0*	5.33	*0*	5.94	*0*	0.86	*0*	1.12	*0*	4.55	*0*
	K (1)	25.26	*15*	5.82	*9*	7.45	*25*	0.97	*13*	1.28	*14*	5.14	*13*
	K (2)	26.61	*21*	6.21	*17*	7.94	*34*	1.02	*19*	1.36	*21*	5.35	*18*
Drainage Water	K (0)	18.06	*0*	4.19	*0*	4.67	*0*	0.72	*0*	0.95	*0*	3.78	*0*
	K (1)	19.12	*6*	4.63	*11*	5.99	*28*	0.83	*15*	1.07	*13*	4.37	*16*
	K (2)	21.25	*18*	4.95	*18*	6.38	*37*	0.88	22	1.13	*19*	4.52	*20*
Nile Water	Control	20.25	*0*	5.04	*0*	5.69	*0*	0.85	*0*	1.08	*0*	4.66	*0*
	Gyps	22.94	*13*	5.56	*10*	7.31	*28*	0.91	*7*	1.15	*6*	4.95	*6*
	FYM	25.56	*26*	5.96	*18*	7.15	*26*	0.99	*16*	1.34	*24*	5.07	*9*
	Gyps+FYM	30.19	*49*	6.59	*31*	8.28	*46*	1.06	*25*	1.44	*33*	5.37	*15*
Drainage Water	Control	16.85	*0*	4.05	*0*	4.93	*0*	0.67	*0*	0.82	*0*	3.59	*0*
	Gyps	18.04	*7*	4.43	*9*	5.63	*14*	0.72	*7*	0.90	*10*	3.90	*9*
	FYM	19.97	*19*	4.78	*18*	5.66	*15*	0.85	*27*	1.14	*39*	4.38	*22*
	Gyps+FYM	23.30	*38*	5.14	*28*	6.50	*32*	0.98	*46*	1.34	*63*	4.95	*38*

The values of I.P (%) in Table 6 indicate that the beneficial effects of these amendments in increasing N, P, K-uptake (kg/fed.) by grains were more obvious in wheat plants irrigated with Nile water than those which irrigated with drainage water. Nevertheless, an opposite trend was noticed in straw, whereas the beneficial effects of applied amendments in increasing these nutrients uptake (kg/fed.) by straw were more obvious under the conditions of irrigation with drainage water than Nile water.

The possibility of FYM to provide plants with their essential elements and their effects on soil characteristics was discussed along time ago with many scientists. Saber (1997) stated that F.Y.M provide soil with nutrient elements during their decomposition, attention needs to be paid to the weather and time of application to prevent the losses of N, P and K, which usually take place during the decomposition of the fresh F.Y.M in soil. El-Maghraby (1997) reported that the favorable effect of manures on increasing N, P and K contents of wheat plants is partly due to the physicochemical properties of the soil as well as the role of organic manures on the supply of nutrients. Where the decomposition of such materials induced the slow release of nutrients in available form to plants throughout the growth period. In addition, organic manures influence the physical, chemical and biological properties of the soil, which, in turn influence the development of the growing plants (FAO, 1977). Also, the studies of Sakr *et al.* , (1992) on wheat and Negm *et al.*, (2002) on corn showed that application of F.Y.M increased significantly N, P and K contents in the studied plants.

On the other hand, chemical amendments, which are commonly used, include ($CaSO_4.H_2O$) and the elemental sulfur, which could be oxidized biologically in soil to produce H_2SO_4 which react with native $CaCO_3$ to form $CaSO_4$ (Curtin *et al.*, 1993). The addition of acid form amendment lowers the soil pH, with well-known effects upon the availability of some nutrients in the soil, then increasing their uptake and contents in plants (Hilal and Abdel-Fattah, 1987). Gypsum had favorable effects on increasing N, P and K contents in wheat (Abou El-Defan *et al.*, 1999). In addition, Sachdev and Deb (1990) showed that addition of gypsum as well as F.Y.M increased the growth and improved the nutrimental status of wheat crop.

GENERAL CONCLUSION

From the previous discussion, it can reported that treating the soil with Gypsum + F.Y.M as well as the potassium fertilization, insure good environmental conditions for wheat plants to grow healthy and also make easily to use saline water or drainage water for irrigating plants, which could help in solving the problem of shortage in fresh water resources. Thus, abundant yield with good quality can be achieved and food production can be increased.

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تأثير التسميد البوتاسى ومحسنات التربة على القمح المروى نوعيات مختلفة مــن مياه الرى

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أجرى هذا البحث فى محطة البحوث الزراعية بالسرو محافظة دمياط،٢٠٠٢/٢٠٠٣ لدراسة تأثير النسميد البوتاسى (صفر،٢٤ ،٤٨ كجم/ فدان) ومحسنات التربة (جبس زراعى بمعدل ٦ طن / فدان أوالسماد
بلدى بمعدل ٢٠ م^3 / فدان أو من خليط منهما وبنفس معدلاتهم) على محصوت الحبوب والقــش ومحتواهم من عناصر النتروجين والفوسفور والبوتاسيوم تحت ظروف الرى بماء النيل أو ماء المصارف. وقد أوضحت النتائج التحصل عليها مابلى:

- حدوث نقص فى مكونات محصول القمح (محصول الحبوب"أردب / فدان" ووزن الألف حبة"جرام" ومحصول القــش" طن /فدان") بسبب الرى بماء المصارف عن الرى بماء النيل.

ولكن التسميد البوتاسى أدى إلى حدوث زيادة فى مكونات المحصول سوا كان الرى بماء النيل أو ماء المصارف .

ومن ناحية اخرى ، أدت اضافة أى من محسنات التربة إلى حدوث زيادة معنوية فى كل مكونات المحصول وذلك مقارنة بالمعاملة صفر محسنات وكانت هذه الزيادة أكثر تميزا تحت ظروف الرى بماء النيل، وكانت أكثر المعاملات تأثيرا فى إحداث الزيادة هى المعاملة الخليط من كلا المحسنين .

- أدى الرى بماء النيل إلى حدوث زيادة معنوية فى إمتصاص عناصر النتروجين والفوسفور والبوتاسيوم بواسطة الحبوب والقش ، بينما لم يتأثر تركيز تلك العناصر فىمحصول القش بإختلاف نوعية مياه الرى المستخدمة.

وقد أدت زيادة جرعة التسميد البوتاسى وبصورة عامة إلى حدوث زيادة معنوية فى تركيزات (%) أو إمتصاص (كجم / فدان) لعناصر النتروجين والفوسفور والبوتاسيوم لكلا من حبوب وقش القمح مقارنة بمعاملة الكونترول (صفر تسميد بوتاسى) تحت ظروف الرى بأى نوعية مستخدمة تحت ظروف الدراسة من ماء الرى .

كما أدت معاملة التربة بالجبس الزراعى أو السماد البلدى سواء كان فى صورة منفردة أو فى صورة خليط إلى حدوث زيادة فى محتوى عناصر النتروجين والفوسفور والبوتاسيوم فى الحبوب أو القش مقارنة بمعاملة الصفر محسنات ، وكان التأثير الأكثر وضوحا لمعاملة الخليط من كلا المحسنين يليها معامل السماد البلدى منفردا وذلك تحت الرى بماء النيل أو ماء المصارف .

- تؤدى معاملة التربة بخليط من الجبس الزراعى والسماد البلدى بجانب التسميد البوتاسى إلى توفير ظروف بيئية جيدة تمكن من إستخدام الماء المالح أو ماء المصارف فى الرى مع النمو والمحصول الجيد للقمح وهذا يساعد فى حل مشكلة نقص مصادر المياة العذبة.