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Effect of Mineral and Bio - Fertilizers on Productivity of Wheat (*Triticum astivum L.*) under South West Suez Canal Conditions

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ABSTRACT

Two field experiments were carried out during 2014 / 2015and 2015 / 2016 seasons in the Kabret El-Bahara area , Suez Governorate to study, the response of wheat Sids 13 cultivar to the combination between five levels of mineral fertilization (without, N.P.K. fertilization, 40 of the recommended, 60, 80 and 100% rate) and spring with five levels bio- fertilizers treatments (without (tap water), bacteria (Azospirillum) 150 ml., bacteria (Rezobium) 150 ml., bacteria (Azotobacter) 150 ml. and Bio- Green Merakl compound 250 ml./200 liters/ fed. Using the split plot design which, the bio-fertilizers treatment were distributed in the main plots, whereas mineral fertilization in subplots in four replicates.The obtained results can be summarized as follows:The results showed that a significant increase in yield and yield components using ground mineral fertilization at the rate of N.P.K. fertilization ware 100% in the 1st.seson and 80%of the recommended, dose in both seasons, respectively, without any significant between 80 and 100%, respectively. Also, the findings revealed that the five bio- fertilizers of marked differences were significant and increased the yield and yield components and the best bio-fertilizer was a Bio-Green Merakl compound 250 ml., in both seasons.The interaction between mineral and bio- fertilizers gave sign increases in yield and its component. The best practice at a rate of N.P.K. fertilization is 80% of the recommended + spraying with Bio-Green Merakl compound of 250 ml. /fed., in both seasons.The results showed also that mineral fertilization at the rate of 80% of the recommended and spraying with Bio-Green Merakl compound 250 ml of resulted in significant increase, in the chemical components of wheat grains namely: nitrogen, total protein, phosphorus and potassium in both seasons.It was found from the calculation of the economic yield of crop that the use of the high rate of mineral fertilization at the rate 80% of the recommended and spraying with Bio-Green Merakl 250 ml /fed is the best experimental economic transaction for the farmer under South West of Suez Canal conditions.

INTRODUCTION

Wheat (*Triticum astivum, L*). is one of the most important cereal crops used in human food and animal feed in Egypt. Increasing wheat production is an essential national target, therefore, a great attentions of several investigators have been directed to increase the productivity of wheat to minimize the gap between the Egyptian production and consumption by increasing the cultivated area and wheat productivity per unit area.

Nutrition is essential for plant life and yield therefore the mineral fertilization is a common agronomic practice that leads to improve the productivity of the tested cultivars. But, with the steadily increasing prices of chemical fertilizers especially nitrogen fertilizers and the pollution problems of soil and water. Application of nitrogen fertilizer is required for efficient wheat production, particularly in arid and semiarid zone when the amount of available nitrogen in the soil is considered to be very low compared to the relatively very high amount of nitrogen requirements of the crop,

Maintaining soil fertility and use of plant nutrients in sufficient and balanced amounts is one of the key factors in increasing crop yield (Diacono *et al*., 2013). Nitrogen is the most important nutrient supplied to most non-legume crops, including wheat. The most important role of N in the plant is its presence in the structure of protein and nucleic acids, which are the most important building and information substances of every cell. In addition, N is also found in chlorophyll that enables the plant to transfer energy from sunlight by photosynthesis. Thus, N supply to the plant will influence the amount of protein, amino acids, protoplasm and chlorophyll formation. Moreover, it influences the cell size, leaf area and photosynthetic activity (Azeez, 2009; Daneshmand *et al*., 2012;Namvar *et al*., 2012; Diacono *et al*., 2013 and Piccinin *et al*., 2013). Therefore, adequate supply of N is necessary to achieve high yield potential in crops. N fertilizer is known to affect the yield and yield components of wheat (Kizilkaya, 2008; Abedi *et al*. 2010; Kandil *et al*., 2011 and Wortman *et al*., 2011).

Biofertilizer contains live or latent cells of efficient strains of nitrogen fixing, phosphate solubilizing or cellulolytic micro-organisms used for application to seed, soil or composting areas to accelerate microbial processes to augment the extent of availability of nutrients. Biofertilizer play a pivotal role for increasing the number of microorganisms and accelerate certain microbial processes in the rhizospher of inoculated soil of plant, which can change the available forms of nutrients into plants. Using of either organic or biofertilizers are considered a safe alternative for chemical fertilizers, which cause environmental pollution when they are used extensively (Basha, 2004 and Abdel- Aal *et al.,* 2007). Biofertilizers inoculation significantly increased most growth and yield parameters, yeast had superiority on Azotobacter. Moreover, mixed inoculums, generally, had more favorable effect on the majority of studied of wheat plant parameters than single inoculants (Ahmed- Amal *et al.,* 2011). Combined application of bio fertilizers caused considerable increase in plant height over all single treatments. Tillering enhanced significantly due to application of bio-fertilizers either alone or in combination. Greater wheat tillering was noticed when the crop received combined treatments than other single treatments. Similar trend of results was also observed in case of yield components of wheat such as spikes /m^2, grains/spike and 1000- grains weight when the crop received bio-fertilizers either alone or combined. Accordingly, the highest grain yield was recorded when the crop received combined bio-fertilizers (Singh and Prasad, 2011). Whereas, biofertilizer (*Azotobacter* sps.) treatment applied alone was very effective in promoting physiological parameters. However, 50% mineral N +biofertilizer with *Azotobacter* and Azospirillum resulted in also higher values for the above mentioned traits comparing with (100% nitrogen and uninoculated), but the differences among the two treatments almost did not attain the statistical differences. They concluded that the biofertilizers (double-inoculation of *Azotobacter* and *Azospirillum*) of efficient strains could save 25 or 50 % of the recommended dose of mineral N (Abd El-Lattief, 2012). With respect to the response of multi-strain application, significant increments were recorded in number of grains/main head, number of grains/tiller and yield. Organic and biofertilizer led to an increase in number of reproductive tillers/plant, number of grains /main head, number of grains /tiller, number of grains/plant, plant yield, 1000 - grains weight and grain yield/ fed.

At last, the aim of this investigation was designed to study the effect of mineral and bio-fertilizers and their interactions on yield and its components and chemical compositions of wheat crop in the Kabret El-Bahara area - Suez Governorate.

MATERIALS AND METHODS

Two successive field experiments were carried out during 2014 / 2015-2015 / 2016 seasons in the Kabret El-Bahara area - Suez Governorate. to study the response of wheat Sids 13 cultivar to the combination between five levels of mineral fertilization (without, N.P.K. fertilization is zero,40, 60, 80 and 100%) 0f the recommended rates and five levels of bio-fertilizers treatments (without application, bacteria (Azospirillum) 150 ml., bacteria (Rezobium)150 ml., bacteria (Azotobacter) 150 ml. and Bio-Green Merkel compound 250 ml./200 liters/fed.

A split plot design with four replicates was used. the main plots were occupied by the bio-fertilizer treatments and sub- plots were devoted to the mineral fertilizer treatments. Each experimental unit contained was 5m^2 (2.5 x 2.0 m). The general agricultural practices were used for seeding the wheat crop. The seeds were sowing on November15th in both seasons. Before sowing, all plots received 30m^2/ fed organic fertilizer.

Nitrogen fertilizer (as ammonium nitrate 33.5% N) was added in three doses at a rate of 100 kg N/fed. The recommended dose 20 % was added at sowing time, 40 % added at 25 days after sowing and the third dose 40 % was applied 50 days after sowing. Super- phosphate fertilizer (15.5 % P_2O_5) was applied before sowing at the rate of 150 kg / fed. (The recommended rat150 kg. super-phosphate).Also, potassium fertilizer was applied before sowing at a rate of 50 kg/fed in the form of potassium sulphate (48% k_2o) (The recommended dose). Mechanical and chemical analysis of the experimental soil is shown in Tables (1) according to Jackson (1967).

Table 1. Physical and chemical analysis of the experimental soil.

Physical analysis					
Soil depth(Cm)	**Coarse sand**	**fine sand**	**Silt**	**Clay**	**Textural class**
			2014		
0-30	38.31	41.52	10.38	9.79	Sandy loam
30-60	37.25	42.73	12.35	7.67	Sandy loam
			2015		
0-30	47.92	34.92	5.98	11.18	Sandy loam
30-60	26.82	60.01	5.13	8.04	Sandy loam

chemical analysis											
Soil depth(C)	pH	EC (dS/m)	Soluble cations (me/L)				Soluble anions (me/L)				O.M. (%)
			Ca++	Mg++	Na+	K+	Co_3^-	HCO_3^-	Cl^-	SO_4^-	
						2015					
0-30	7.25	11.78	42.41	14.14	58.39	1.35	54.79	3.44	33.1	79.98	0.18
30-60	7.35	10.35	39.26	13.09	47.71	1.34	50.24	3.88	39.8	59.15	0.12
						2016					
0-30	7.89	10.24	37.85	12.27	50.79	1.34	54.8	2.993	28.8	69.583	0.15
30-60	8.03	9.004	36.08	11.38	41.50	1.16	48.15	3.376	34.6	51.461	0.10

Regular irrigation every one week after sowing was practiced. The meteorological data of Kabret El-Bahara area was shows in Table (2).Wheat yield of the two inner ridges were determined for each sub- plot and a sample of five tillers were taken at harvesting time at random to estimate the following characters:

Plant height (cm). Spike length (cm).
Number of spikes /m^2. Number of grains / spike.
Grains weight/ spike (g). 1000 - grain weight (g).
Grain yield (ton/fed). Straw yield (ton/fed).
Biological yield (ton/fed).

Chemical analysis of grains at harvest for K was estimated by using Flame Photometer, total nitrogen percent was expressed as crude protein by multiplying the total nitrogen by 5.9, Total carbohydrate percent was determined according to A.O.A.C. (1990).

The mean values were compared according to the procedures of analysis of variance (ANOVA) by using LSD at the level of 5% of significance (Snedecor and Cochran ,1980). All statistical analyses were performed by using analysis of variance technique by means of "IRRISTAT" computer software package.

Economic Assessment:

A comprehensive economic assessment of the experiment (for both inputs and outputs of the experiment) is performed.

Table 2. Meteorological data under South West Suez Canal conditions.

Month	**Temperature (C)**			**Relative Humidity (%)**	**Wind Speed (km/h)**	**Precipitation (mm)**
	Max	**Min**	**Mean**			
			2014 /2015			
November	26.1	14.5	20.3	64	11.63	0
December	22.2	10.0	16.1	58	6.18	15
January	21.0	8.5	14.8	62	6.25	25
February	19.5	7.5	13.5	52	2.44	22
March	22.2	9.6	15.9	53	5.84	22
April	26.3	12.4	19.4	46	4.22	8
			2015 /2016			
November	26.0	13.7	19.9	61	11.20	0
December	21.0	10.0	15.5	60	6.34	16
January	20.1	8.3	14.2	60	3.61	25
February	21.1	9.5	15.3	61	6.00	19
March	23.1	10.7	16.9	51	6.82	15
April	26.9	14.8	22.2	47	9.55	3

RESULTS AND DISCUSSION

I: - Yield and yield components.

Results in Tables (3 and 4) show that the soil additions of mineral fertilization to wheat crop resulted in a significant increases in the yield and yield components. The highest yield obtained from rate of N.P.K. fertilization is 80% of the recommended rate compared with the rest of the other treatments in yield and yield component i.e., plant height, spike length, no. of spikes /m^2, no. of grains / spike, grains weight / spike, 1000 - grain weight and grain, straw and biological yields/ fed. While, there were no significant differences between the mineral levels only 80% and the level of 100% of the recommended rates in both seasons. Therefore, give a higher economic return and also preserves the vitality of the soil and protects them from salinization.The same results were obtained by El Habbasha, *et al.* (2013) Hossein and Farshad (2013) Nassar Rania *et al.* (2015) and Abd El-Salam, *et al.* (2016).

Table 3. Effect of mineral and bio- fertilizers on wheat yield and its components in 2014/ 2015 and2015/ 2016 seasons.

Characters treatments		Plant height (cm.)		Spike length (cm.)		No.of grains/ spike		No.of spikes / m^2		Grain weight/ spike(g.)	
		1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.
	M.f.1	84.35	85.54	12.84	12.62	34.66	34.25	233.21	235.54	1.641	1.624
	M.f.2	86.91	86.59	13.09	12.79	35.82	35.01	233.51	234.47	1.684	1.711
Bio.1	M.f.3	88.28	89.24	13.58	13.78	37.24	36.84	235.29	236.48	1.712	1.735
	M.f.4	89.48	90.37	13.92	14.35	38.29	38.54	237.11	239.39	1.743	1.759
	M.f.5	91.08	92.21	14.28	14.52	38.67	38.78	239.37	241.01	1.780	1.807
Mean		88.02	88.79	13.59	13.61	36.93	36.68	235.69	237.37	1.712	1.727
	M.f.1	88.68	88.37	14.00	14.66	37.92	37.45	238.49	239.88	1.725	1.768
	M.f.2	91.54	93.02	15.02	15.46	39.24	40.19	240.17	242.10	1.798	1.812
Bio.2	M.f.3	93.59	95.05	15.38	15.89	40.52	41.34	241.62	244.20	1.856	1.877
	M.f.4	95.61	96.87	16.64	16.80	42.39	42.76	244.19	246.80	1.881	1.901
	M.f.5	97.35	98.27	17.18	17.68	44.50	45.18	245.56	247.90	1.934	1.966
Mean		93.35	94.31	15.64	16.09	40.91	41.38	242.00	244.17	1.838	1.864
	M.f.1	95.28	97.59	16.89	17.51	41.37	42.48	244.00	247.51	1.912	2.002
	M.f.2	103.28	104.25	18.02	18.99	45.49	44.37	247.35	248.62	1.985	2.128
Bio.3	M.f.3	107.38	107.00	18.92	19.34	47.83	47.00	249.57	251.05	2.110	2.212
	M.f.4	109.48	109.12	19.75	19.62	48.44	48.68	252.08	253.94	2.186	2.324
	M.f.5	112.04	114.68	20.18	20.57	49.61	50.18	253.45	255.78	2.211	2.356
Mean		105.49	106.52	18.75	19.20	46.54	46.54	249.29	251.38	2.080	2.204
	M.f.1	111.38	114.68	18.95	19.68	47.64	48.29	251.48	253.12	2.175	2.264
	M.f.2	115.38	117.25	19.67	20.31	50.22	51.48	255.67	257.25	2.325	2.345
Bio.4	M.f.3	116.28	117.24	20.86	21.84	51.31	52.63	259.73	260.67	2.389	2.458
	M.f.4	118.02	120.20	21.38	21.59	52.48	54.16	261.75	263.63	2.548	2.627
	M.f.5	120.29	121.94	22.48	23.33	53.71	54.28	263.83	269.58	2.578	2.613
Mean		116.27	118.26	20.66	21.35	51.07	52.16	258.49	260.85	2.403	2.461
	M.f.1	117.35	118.39	20.45	21.08	51.64	52.17	260.47	265.27	2.486	2.534
	M.f.2	121.58	123.49	22.67	23.58	54.58	53.64	266.48	269.84	2.579	2.624
Bio.5	M.f.3	124.68	125.36	23.59	24.22	57.66	55.48	273.44	275.68	2.644	2.681
	M.f.4	128.64	128.89	24.54	24.88	59.22	59.55	278.25	276.35	2.788	2.798
	M.f.5	126.39	126.98	23.28	23.11	58.17	58.48	276.82	275.33	2.692	2.681
Mean		123.72	124.62	22.90	23.37	56.25	55.86	271.09	272.49	2.637	2.663
	M.f.1	99.40	100.91	16.62	17.11	42.64	42.92	245.53	248.26	1.987	2.038
Mineral	M.f.2	103.73	104.92	17.69	18.22	45.07	44.93	248.63	250.45	2.074	2.124
fertilizer	M.f.3	106.04	106.77	18.46	19.01	46.91	46.65	251.93	253.61	2.142	2.192
M.f.	M.f.4	107.79	108.70	19.24	19.44	48.16	48.73	254.67	256.02	2.229	2.281
	M.f.5	109.88	111.19	19.48	19.84	48.93	49.38	255.80	257.92	2.239	2.284
Mean		105.36	106.49	18.29	18.72	46.34	46.52	251.31	253.25	2.134	2.183
L.S.D. 5% (M.f.)=		1.089	1.092	0.545	0.544	0.864	0.866	1.058	1.061	0.321	0.322
(Bio.)=		1.087	1.088	0.522	0.520	0.858	0.860	1.056	1.058	0.322	0.321
(M.f.)x(Bio.)=		0.975	0.978	0.324	0.321	0.668	0.669	0.842	0.844	0.249	0.245

Bio = Biofertilizer.Bio1= without (tap water).Bio2= Azospirillum.Bio3= Rezobium.Bio4= Azotobacter.Bio5= Bio-Green Merkel.
M.F. = mineral fertilizers (recommended doses).
M.F.1 = without, N.P.K. fertilization is zero.
M.F.2=40% of the recommended N. P. K. fertilization.
M.F.3=60% of the recommended N. P. K. fertilization.
M.F.2=80% of the recommended N. P. K. fertilization.
M.F.2=100% of the recommended N. P. K. fertilization.

Table 4. Effect of mineral and bio- fertilizers on wheat yield and its components in 2014/ 2015 and2015/ 2016 seasons.

Characters treatments		1000- Grain weight (g.)		Grain yield (Ton / Fed.)		Straw yield (Ton / Fed.)		Biological yield (Ton / Fed.)	
		1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.
	M.f.1	40.42	40.52	2.445	2.466	3.814	3.834	6.359	6.400
	M.f.2	41.38	41.69	2.524	2.554	3.924	3.965	6.548	6.619
Bio.1	M.f.3	42.64	42.77	2.645	2.769	3.981	3.978	6.726	6.747
	M.f.4	43.68	43.10	2.698	2.725	4.035	4.110	6.832	6.935
	M.f.5	44.86	44.49	2.712	2.737	4.078	4.175	6.890	7.012
Mean		42.59	42.51	2.604	2.630	3.966	4.012	6.671	6.742
	M.f.1	42.58	42.66	2.659	2.685	3.986	4.008	6.745	6.793
	M.f.2	43.39	44.00	2.752	2.767	4.045	4.112	6.897	6.979
Bio.2	M.f.3	44.71	44.81	2.795	2.801	4.087	4.179	6.982	7.080
	M.f.4	44.91	45.08	2.812	2.834	4.128	4.235	7.040	7.169
	M.f.5	45.54	45.68	2.838	2.859	4.238	4.267	7.176	7.226
Mean		44.22	44.44	2.771	2.789	4.096	4.160	6.968	7.049
	M.f.1	43.67	43.73	2.724	2.800	4.069	4.100	6.893	7.000
	M.f.2	45.28	46.00	2.838	2.854	4.211	4.273	7.149	7.227
Bio.3	M.f.3	45.94	46.89	2.856	2.887	4.259	4.358	7.215	7.345
	M.f.4	46.78	47.12	2.887	2.926	4.367	4.457	7.354	7.483
	M.f.5	47.69	47.76	3.019	3.084	4.428	4.489	7.447	7.573
Mean		45.87	46.30	2.944	2.990	4.266	4.335	7.211	7.325
	M.f.1	45.25	45.81	2.869	2.928	4.228	4.310	7.097	7.238
	M.f.2	46.37	46.72	2.924	2.979	4.367	4.427	7.291	7.406
Bio.4	M.f.3	47.54	48.34	2.945	3.054	4.456	4.477	7.401	8.017
	M.f.4	48.91	48.51	2.981	3.110	4.531	4.588	7.512	7.698
	M.f.5	49.67	49.70	3.089	3.186	4.618	4.700	7.707	7.883
Mean		47.54	47.81	2.961	3.051	4.440	4.500	7.401	7.648
	M.f.1	47.98	48.68	2.957	3.091	4.421	4.523	7.378	7.614
	M.f.2	49.20	49.70	3.067	3.121	4.687	4.725	7.754	7.846
Bio.5	M.f.3	51.20	50.89	3.112	3.198	4.789	4.811	7.901	8.009
	M.f.4	52.34	52.87	3.211	3.292	4.942	4.978	8.152	8.270
	M.f.5	51.84	52.00	3.164	3.176	4.834	4.821	7.998	7.997
Mean		50.51	50.82	3.102	3.175	4.734	4.771	7.836	7.947
	M.f.1	43.98	44.28	2.690	2.754	4.103	4.155	6.893	7.009
	M.f.2	45.12	45.62	2.781	2.815	4.246	4.300	7.127	7.215
	M.f.3	46.40	46.74	2.830	2.881	4.314	4.360	7.244	7.341
M.f.	M.f.4	47.32	47.33	2.977	3.037	4.400	4.473	7.377	7.510
	M.f.5	47.92	47.92	3.004	3.048	4.439	4.490	7.443	7.538
Mean		46.14	46.37	2.916	2.967	4.300	4.355	7.216	7.322
L.S.D.5%(M.f.)=		0.982	0.984	0.088	0.089	0.092	0.093	0.091	0.092
(Bio.)=		0.961	0.964	0.087	0.088	0.091	0.092	0.091	0.092
(M.f.)x(Bio.)=		0.451	0.452	0.075	0.075	0.078	0.078	0.076	0.075

The results also indicated that spraying of different types of bio-fertilizers increased significant the yield and its components in both seasons compared with spraying by tap water. The best higher values in yield and its components were observed due to the addition of the Bio-Green Merkel compound 250 ml /200 liters/ fed. Then the lower of the bacteria (Azospirillum) 150 ml /200 liters, bacteria (Rezobium) 150 ml /fed, (Azotobacter) 150 ml /fed, arranged after Bio green Merkle 250 ml /fed, respectively. Where, the lowest values of the yield and yield components were seen for the un- biological fertilizer treatment.In order to explain these results, it may be noted that the Bio-Green Merkel compound contains the elements that act to stabilize the air nitrogen of a plant such as wheat and maintain the proportion of C / N ratio, which leads to increase the grain felling rate of the spike and work on the high efficiency of the effective period of grain filling, which leads to increase the yield and its components compared with other Bio- fertilizers in the experiments. These results are in agreement with those obtained byGomaa *et al.* (2011) Amal - Ahmed *et al.* (2012), Ali Namvar (2013) Abdel- Razek and El – Sheshtawy (2013) and Nassaret- Rania. *et al.* (2015).

The interaction between soil applications of mineral fertilizer at a rate of N.P.K. is 80% of the recommended and spraying by of the Bio-Green Merkel compound 250 ml /fed gave the highest values in yield and its components, while the lowest values were given when using the treatment without adding ground mineral fertilization with spraying and tap water. The percentage of increases in these characteristics i.e.: plant height, spike length, number of spikes /m^2, number of grains / spike, grains weight/ spike, 1000 - grain weight and grain, straw and biological yields were 32.81%, 40.83%, 40.67%, 16.18%, 39.59%, 23.07%, 20.74%, 22.82 % and 21.19%in the first season, While, 33.24%, 40.97%, 40.84%, 17.51%, 39.68%, 24.11%, 21.08%, 23.01% and 22.03% were seen in the second season , respectively.

In this regard, Ali Namvar (2013) found that the combined effect of mineral and bio-fertilization on the productivity of wheat yield and yield components had a strong association with the N fertilization, bio-fertilizer inoculation and weed interference. Higher rates of N fertilization and bio-fertilizer (*Azotobacter* sp. and *Azospirillum* sp.) inoculation increased plant height, spike number per unit area, grains / fed, number per spike, 1000-grain weight, grain and biological yields/ fed. Application of 150 kg N ha^{-1} was statistically in par with 200 kg N ha^{-1} in the most of the studied traits. Similar results were obtained by Ahmed- Amal *et al.* (2012), Radwan *et al.*(2015), and Abd El-Salam *et al.* (2016).

II: - chemical composition of wheat grains:

The results in Table (5): ill reveal that the chemical analysis of wheat grains mineral due to mineral fertilizers was sign increases in both seasons. The difference between 80 and 100% of respect was not significant as for nitrogen, phosphorus, potassium, total crud protein and total carbohydrate percent as compared with the un- fertilizer treatment. With the addition of the rate of N.P.K. fertilization 80% of the recommended led to a significant increase in the percentage at total protein. The results showed that the use of spraying by in the Bio-Green Merkel compound 250 ml /fed gave significant differences in the rests of the other biochemical compounds in all studied traits. Similar results were obtained by Yassen *et al.* (2010),Gomaa *et al.* (2011), El Habbasha *et al.* (2013) and Radwan *et al.*(2015).

Table 5. Effect of mineral and bio- fertilizers on wheat chemical composition in 2014/ 2015 and2015/ 2016 seasons.

Characters treatments		Nitrogen content		Phosphorus content		Potassium content		Total crud protein (%)		Total Carbohydrate	
		1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.	1st.	2nd.
Bio.1	M.f.1	1.924	1.932	0.221	0.227	0.341	0.338	11.35	11.39	67.45	67.81
	M.f.2	1.955	1.962	0.228	0.228	0.344	0.343	11.53	11.57	67.72	67.75
	M.f.3	1.972	1.973	0.234	0.236	0.349	0.348	11.63	11.64	68.27	68.33
	M.f.4	1.989	1.994	0.239	0.240	0.351	0.351	11.73	11.76	68.91	68.89
	M.f.5	2.011	2.014	0.245	0.244	0.354	0.353	11.86	11.88	68.99	69.10
Mean		1.970	1.975	0.233	0.235	0.347	0.346	11.62	11.64	68.26	68.37
Bio.2	M.f.1	1.964	1.968	0.238	0.239	0.347	0.346	11.58	11.61	67.65	67.87
	M.f.2	1.987	1.982	0.241	0.242	0.351	0.352	11.72	11.69	67.78	67.92
	M.f.3	2.034	2.025	0.249	0.249	0.354	0.354	12.00	11.94	67.83	68.11
	M.f.4	2.095	2.093	0.253	0.254	0.358	0.359	12.36	12.34	68.09	68.24
	M.f.5	2.127	2.122	0.258	0.257	0.361	0.362	12.54	12.51	68.22	68.51
Mean		2.041	2.038	0.247	0.248	0.354	0.354	12.04	12.01	67.91	68.12
Bio.3	M.f.1	2.044	2.044	0.251	0.252	0.353	0.354	12.05	12.05	67.88	67.89
	M.f.2	2.115	2.117	0.260	0.261	0.358	0.358	12.47	12.49	67.97	68.12
	M.f.3	2.168	2.167	0.264	0.265	0.361	0.362	12.79	12.78	68.16	68.23
	M.f.4	2.200	2.202	0.269	0.267	0.365	0.366	12.98	12.99	68.56	68.76
	M.f.5	2.217	2.218	0.272	0.273	0.367	0.368	13.08	13.08	68.78	68.87
Mean		2.148	2.149	0.263	0.263	0.360	0.361	12.67	12.67	68.27	68.37
Bio.4	M.f.1	2.159	2.164	0.265	0.266	0.359	0.360	12.73	12.76	68.65	68.66
	M.f.2	2.197	2.199	0.271	0.272	0.362	0.363	12.96	12.97	69.12	69.36
	M.f.3	2.239	2.237	0.276	0.277	0.368	0.367	13.21	13.19	69.60	69.79
	M.f.4	2.250	2.254	0.279	0.281	0.372	0.374	13.27	13.29	69.73	70.09
	M.f.5	2.287	2.289	0.281	0.284	0.378	0.379	13.49	13.50	70.54	70.88
Mean		2.226	2.228	0.274	0.276	0.367	0.368	13.13	13.14	69.52	69.75
Bio.5	M.f.1	2.164	2.165	0.278	0.278	0.366	0.369	12.76	12.77	69.38	69.80
	M.f.2	2.284	2.287	0.283	0.284	0.377	0.378	13.47	13.49	70.84	70.68
	M.f.3	2.305	2.311	0.289	0.288	0.384	0.388	13.59	13.63	71.53	71.88
	M.f.4	2.355	2.365	0.297	0.298	0.394	0.399	13.89	13.95	72.83	72.84
	M.f.5	2.345	2.350	0.292	0.293	0.389	0.394	13.83	13.86	71.74	71.66
Mean		2.289	2.295	0.287	0.288	0.382	0.385	13.50	13.54	71.26	71.37
M.f.	M.f.1	2.051	2.054	0.250	0.252	0.353	0.353	12.10	12.11	68.20	68.40
	M.f.2	2.107	2.109	0.256	0.259	0.358	0.358	12.43	12.44	68.68	68.76
	M.f.3	2.143	2.142	0.262	0.263	0.363	0.363	12.64	12.63	69.07	69.26
	M.f.4	2.177	2.181	0.267	0.268	0.368	0.367	12.84	12.86	69.62	69.76
	M.f.5	2.197	2.198	0.269	0.270	0.369	0.371	12.96	12.96	69.65	69.80
Mean		2.135	2.136	0.260	0.262	0.362	0.362	12.59	12.60	69.04	69.19
L.S.D. 5% (M.f.)=		0.023	0.024	0.018	0.019	0.021	0.022	0.034	0.035	0.055	0.056
(Bio.)=		0.022	0.022	0.018	0.019	0.021	0.022	0.033	0.034	0.052	0.054
(M.f.)x(Bio.)=		0.018	0.018	0.014	0.014	0.015	0.015	0.021	0.022	0.034	0.033

The interaction between soil applications of mineral fertilizers at a rate of N.P.K. fertilization is 80% of the recommended and spraying by of the Bio-Green Merkel compound 250 ml /fed gave the highest values of the chemical analysis of wheat grains. The percentages of increases in the qualities of the studied characteristics as for nitrogen, phosphorus, potassium, total crud protein and total carbohydrate were 16.98%, 20.23%, 12.69%, 16.99% and 07.13% in the first season, While, they were 17.21%, 21.01%, 12.78%, 17.11% in the second season, respectively. As compared significantly increased all chemical composition thrall the other bio-fertilizer. Similar results were obtained by Yassen et al. (2010), Gomaa *et al.* (2011), El-Habbasha *et al.* (2013), Radwan et al.(2015) and Abd El-Salam *et al.* (2016).

III: - The economic assessment of the experiment:

Data in table (6 and 7) reveal assessment of the experimental inputs and outputs as well as the ratio between outputs and inputs for each treatment introducing investment ratio (IR) under the condition of South West Suez Canal conditions, The results indicated the progressive increment in IR by increasing of wheat crop Sids, 13 cultivar to combination between mineral fertilization, five levels as affected by five in spraying types of bio-fertilizers.

Found from the calculation of the economic yield and yield components of crop and the use of the high rate of soil additive of mineral fertilization at the rate of N.P.K. is 80 % of the recommended and spraying by the Bio-Green Merkel compound 250 ml /fed is the best experimental economic transaction for the farmer under South West Suez Canal conditions, With the presence of other factors gave an investment rate higher than the national average, which gives a wide range of selection of transactions according to the conditions of the farmer economically.

Table 6. The prices of all agricultural management inputs under the condition of field experiment according to market price.

Economic item	Management type	Unit	Price (L.E.)
Input	Bio- fertilizers	Liter/ fed.	350
	Mineral fertilizationP_2O_5	Bag (50 kg./ fed.)	75
	N. fertilization	Bag (50 kg./ fed.)	150
	K_2O	Bag (50 kg./ fed.)	300
	Management operation		750
	Irrigation water	M^3	0.90
	Seeds	kg. / fed.	120
	Pesticides	Fed.	------------
	Agricultural rent	Fed.	2100
Output	Seed yields	kg. / fed.	24

Table 7. The economic assessment of the experiment treatments due to mineral and bio-fertilizers application of wheat on yields

Bio- fertilizers mineral fertilizers	Economic item	Wheat				
		Bio.1	Bio.2	Bio.3	Bio.4	Bio.5
M.f.1 mineral fertilizers	Input	7296.1	6958.2	6865.2	6734.0	6798
	Output	5448.2	5012.0	5269.0	4883.0	4892
	Investment*	0.74	0.72	0.72	0.69	0.72
M.f.2 mineral fertilizers	Input	7455.2	7014.0	7113.2	6884.1	6882
	Output	5546.0	5158.1	5111.1	6972.1	6994
	Investment*	0.73	0.72	0.72	1.04	1.08
M.f.3 mineral fertilizers	Input	7669.1	7168.0	7258.1	6973.1	6995
	Output	7601.2	6324.0	6124.1	6014.1	7214
	Investment*	0.98	0.88	1.02	0.86	1.10
M.f.4 mineral fertilizers	Input	7732.0	7311.0	7422.1	7288.0	7058
	Output	7856.1	7211.0	7225.2	7985.1	7356
	Investment*	1.01	0.98	1.12	1.11	1.14
M.f.5 mineral fertilizers	Input	7847.5	7858.2	8457.5	8654.1	8675.1
	Output	8857.2	8989.0	9254.1	9512.1	9875.2
	Investment*	1.22	1.28	1.30	1.31	1.34

***Investment ratio = output / input** ****National IR = 1.31 LE output / LE input**

CONCLUSION

This study concluded that wheat crop cultivation is an economic cultivation under South West Suez Canal conditions. We recommend cultivating Sids 13 variety by using mineral fertilization at the 80 % rate of N.P.K. fertilization rate of, i.e.:(80 kg N/ fed plus rate of the recommended 150 kg (15.5% P_2O_5) super- phosphate plus 100 kg /fed in the form of potassium sulphate (48% K_2O) and spraying by of the Bio-Green Merkel compound 250 ml /fed.

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تأثير التسميد المعدنى والحيوى على انتاجية القمح تحت ظروف جنوب غرب قناة السويس

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أقيمت تجربتان حقليتان خلال موسمي ٢٠١٤ / ٢٠١٥ - ٢٠١٥ / ٢٠١٦ في منطقة كبريت البحارة - محافظة السويس. لدراسة استجابة محصول القمح صنف (سدس ١٣) للتسميد المعدنى (N.P.K.) كاضافة ارضية فى خمسة مستويات: بدون اضافة ، ٤٠%، ٦٠%، ٨٠%، ١٠٠ % من المعدل الموصى بة (١٠٠ كجم ن/ فدان) والتسميد الحيوى رشا فى خمسة مستويات: معاملة المقارنة (رش بماء الصنبور) - الرش ببكتيريا أزوسبيريللم بمعدل١٥٠سم٣- الرش ببكتيريا ريزوبيوم بمعدل١٥٠سم٣- الرش ببكتيريا أزوتوباكتر بمعدل١٥٠سم٣- الرش بمركب بيوجرين ميركل بمعدل٢٥٠سم٣ وتم الرش فى طور التفريع واستخدم تصميم القطع المنشقة مرة واحدة إحتوت القطع الرئيسية معاملات التسميد الحيوى، بينما كانت مستويات التسميد المعدنى فى القطع الشقية، وذلك فى أربع مكرارات.ويمكن تلخيص النتائج فيما يلي ."أظهرت النتائج زيادة معنوية في المحصول ومكوناتة باستخدام التسميد المعدني الأرضي بمعدل ٨٠٪ من الموصى به (N.P.K.) ،في كلا الموسمين.بينت النتائج ان التسميد الحيوى بالأنواع المختلفة عن وجود اختلافات معنوية عالية وأيضا نتج عنها زيادة محصول القمح ومكوناتة مقارنة بمعاملة الرش بماء الصنبور وكان أفضل الأسمدة الحيوية هومركب بيوجرين ميركل ٢٥٠ مل/ للفدان، مقارنة بباقى المعاملات ، وذلك فى كلا الموسمين.أدى التفاعل بين التسميد المعدنى والحيوي إلى زيادة المحصول ومكوناتة حيث كانت أفضل المعدلات ٨٠٪ من الموصى به (N.P.K.) + الرش بالسماد الحيوي مركب بيوجرين ميركل ٢٥٠ مل / للفدان ، في كلا الموسمين. وكانت كمية السماد المعدنى الموصى بة (٨٠ كجم/ ن ، ١٥٠ كجم سوبر فوسفات (١٥.٥ % فو٢أ٥)، ٥٠ كجم سلفات بوتاسيوم ٤٨% بو٢أ).بينت النتائج أن التسميد المعدني بمعدل ٨٠٪ من الموصى به (N.P.K.) + الرش بالسماد الحيوي بمركب بيوجرين ميركل ٢٥٠ مل / للفدان، قد أدى إلى زيادة معنوية في نسبة النيتروجين، البروتين الكلي ، الفوسفور والبوتاسيوم ، فى حبوب القمح في كلا الموسمين.وقد وجدمن حساب العائد الاقتصادي للمحصول أن معدل التسميد المعدنى والحيوي قد نتج عنة زيادة المحصول ومكوناتة. كانت أفضل المعاملات اقتصاديا هى التسميد بمعدل ٨٠٪ من الموصى به(N.P.K.) (٨٠ كجم/ ن ، ١٥٠ كجم سوبر فوسفات (١٥.٥ % فو٢أ٥)، ٥٠ كجم سلفات بوتاسيوم ٤٨% بو٢أ) + الرش بالسماد الحيوي مركب بيوجرين ميركل ٢٥٠ مل. / للفدان) ،هى افضل المعاملات التجريبية اقتصاديا للمزارع تحت ظروف جنوب غرب قناة السويس.