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Effect of Organic Sources and Levels under Bio-Fertilization on Wheat Productivity and Soil Properties and its Fertility

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ABSTRACT

Two field experiments were conducted in the Experimental Farm of Sids Agricultural Research Station, ARC, Beni-Suef Governorate during the two successive seasons of 2016/2017 and 2017/2018 to study the affect of organic manure sources (compost and farmyard manure "FYM") and levels (0.0, 5.0 and 10 t/fed) as well as bio-fertilization(with and without) on wheat productivity in term of growth (plant height and dry weight), yield components (number of spikes/m^2, number of grains/spike and 1000-grain wheat), yields (grains and straw) and N,P and K uptake as well as soil properties (pH, EC and organic matter %) and soil fertility (available N, P and K) in soil after wheat harvest. The results reveal that compost had a slightly higher effect on wheat productivity and soil properties and its fertility than FYM. Increasing organic manure levels enhanced all studied growth, yield and yield components and N, P and K uptake in grains and/or straw, except 1000-grain weight which did not affect. Also, increasing manure levels improved all studied soil properties and fertility, except soil salinity which increased due to increasing manure levels. Bio-fertilization enhanced growth, yield and its component and nutrient uptake, except 1000-grain weight. All studied soil properties and fertility did not respond to bio-fertilization. Mixed bio-fertilizer with organic manure at a rate of 10 t/fed resulted in maximum wheat productivity and improved soil properties and fertility of soil after wheat harvest.

Keywords: Wheat, compost, farmyard manure, growth, yield and its components, N, P and K uptake, soil properties and soil fertility.

INTRODUCTION

Sustainable agriculture involves successful management of agricultural resource to satisfy charging human needs, while maintaining or enhancing the environment quality and conserving natural resources (TAC, CGIAR, 1988). Sustainable agriculture relies greatly on renewable resource and on farm nitrogen contribution are achieved largely through biological nitrogen fixation (BNF). Biological nitrogen fixation helps in maintaining and / or improving soil fertility by using N_2 whether in soil or atmosphere. Above every hectare of land at sea level, there is about 78000 tones of inert nitrogen (N_2). Intensive agriculture system are characteristically expanded nutrient cycles involving the export of crops from a farm and require continued import of nutrients to the farm.

In view of the escalating energy costs and energy production, it essential to involve judicious combination of chemical fertilizers, organic manures and bio-fertilizers. In Egypt, agriculture is mainly depended on chemical fertilizers, which its consumption per feddan is more than the average of the whole world. However, because of shortages in some fertilizer supplies, and the current of energy, which is used for its production, the cost of fertilizers has risen tremendously and will continue to rise. In addition, the efficiency of fertilizers used in Egypt is low due to high pH of soil and calcium carbonate levels.

Increased attention is now being paid to develop on Integrated Plant Nutrition System (IPNS) that maintains or enhance soil productivity through balanced use of all sources of nutrients, including chemical-, organic- and bio-fertilizers.

Microbiologists have paid much attention for bio-fertilizer application to improve both quality and quantity of field crops. Rashid *et al* (1998), Hegazi *et al* (1998) and Ghallab and Salem (2001) stated that inoculation of wheat plant with Azopirillum spp. significantly increased its growth and yield productivity. In this concern; Ali, *et al* (2009), Berger *et al* (2013) and Ismail *et al* (2014) stated that bio-fertilizer enhanced the growth of canola, cowpea and soybean plants, respectively.

The organic matter is used since times to improve soil health and supplying plant nutrients. Various types and sources of organic waste are utilized in agriculture but most of these materials remain unutilized, especially in resource poor countries. The organic materials are available in bulk amounts as farm manure, city waste, poultry manure and wastes from industry like food, sugar, cotton and rice (Ibrahim *et al*, 2008). If these materials are accumulated, these may become a potential source of air and land pollution.

Composting provides an effective and environment friendly of organic waste disposal (Millner *et al*, 1998) because it is more economical and environment friendly. It also conserves natural sources and improves cycling of non-renewable resources. Keeping in view the present energy crises, it is an excellent option for energy conservation because a lot of energy is utilized in fertilizer sector. This process biologically converts the organic waste into stable humus like substance, which may be stored and applied without any environmental impacts (Gallardo and Nogales, 1987). The organic manure and compost are important in sustaining farming by providing plant with nutrients and improve physical and chemical soil properties (Korsaeth *et al*, 2002). Many authors stated that organic manure enhanced wheat productivity such as Tahir *et al* (2011) and Shah *et al* (2013).

Furthermore, incorporation of organic manure with bio-fertilize increases the microbiological activity and enhanced the physical and chemical conditions of soil (Berger *et al*, 2013).

This study aimed to compare the effect of bio-fertilizer and /or organic manure (FYM or compost at different levels) under the recommended rate of N, P and K fertilizers on wheat plant and some soil properties and soil fertility after harvest.

MATERIALS AND METHODS

Two field experiments were performed at the Experimental Farm of Sids Agricultural Research Station , ARC, Beni-Suef Govermorate during the two successive seasons of 2016/2017 and 2017/2018 to evaluate the effect of organic manure sources and levels under bio-fertilization on wheat productivity and soil properties. Some physical (according to Klute,1986) and chemical properties (according to Page *et al*, 1982) were determined in surface soil sample (0.0- 30 cm) to represent the characteristics of the experimental soil in the two growing seasons and listed in Table (1).

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

Soil Properties	2016 /2017	2017 /2018
Physical properties:		
Particle size distribution		
clay %	51.8	55.2
Silt %	34.7	30.6
Sand %	13.5	14.2
Texture grade	clay	clay
Chemical properties:		
pH (in 1:2.5 soil- water suspension)	8.01	8.00
EC (in soil paste, dSm^{-1})	1.22	1.16
Organic matter %	1.33	1.25
Available N (mg kg^{-1})	20.2	21.5
Available P (mg kg^{-1})	14.3	14.0
Available K (mg kg^{-1})	140	142

Also, some chemical analysis of the used farmyard manure and compost (from season stalk residual composting) were determined according to Chapman and Pratt (1961) and presented in Table (2).

Table 2. Some chemical composition of the used organic manure.

Chemical composition	Farmyard manure		Compost	
	2016 /2017	2017 /2018	2016 /2017	2017 /2018
pH (1:2.5 soil water suspention)	7.82	7.93	7.01	7.12
EC, dSm^{-1} (1:5 soil-water extraction)	7.15	7.36	6.11	6.35
Organic matter %	21.31	19.93	38.64	37.17
Organic carbon %	12.36	11.56	22.41	21.56
Total nitrogen (%)	0.66	o.63	1.11	1.05
Total phosphorus (%)	0.28	o.27	0.71	0.70
Total potassium (%)	0.46	0.45	1.16	1.14
C/N ratio	1:18.7	1:18.3	1:20.2	1:20.5

Grains of wheat variety Beni-Suef 2 were sown at rate of 80kg / fed in 15 and 17 November and harvesting in May. The experimental design was split-split on complete randomized block with four replicates. The main plots consisted of organic manure sources (farmyard manure (FYM) and compost), while organic levels (0.0, 5.0, and 10.0 t/fed) were allocated in sub plots. The bio-fertilizer treatments (without " - " and with " + ") were devoted in sub-sub plots. Each sub-sub plot size was 3m × 3.5m = 10.5 m^2 = 1/400 fedan. Superphosphate (15.5% P_2O_5) and potassium sulphate (48% K_2O) fertilizers were added before planting during land preparation at rate of 22 kg P_2O_5 /fed and 24kg K_2O / fed. Whereas, nitrogen fertilizer was added at rate of 75kg N/fed as ammonium nitrate (33.5%) at two equal doses, before the first and second irrigations. The preceding crop was maize. All other cultural practices were applied as recommended for wheat production in the district.

After wheat harvest, soil samples were taken from each plot to determine some chemical properties according the method described by Page et at (1982). Also, ten plants were taken randomly from each plot to determine, plant height (cm), dry weight/plant (g), number of grains/spike and100-grain weight (g). Furthermore, number of spikes/m^2 was determined. Grain and straw yields were determined for each plot and converted to ardab and ton /fed, respectively. N, P and K concentrations were determined in wheat grains and straw (according to Chapman and Pratt (1961) and converted to nutrient uptake.

Data were subjected to proper statistical analysis outlined by Snedecor and Cochran (1980). Means were compared using least significant difference test at 0.05 level of probability.

RESULTS AND DISCUSSION

Growth and yield components:

Data in Tables 3 and 4 represent the effect of organic sources and levels as well as bio-fertilization on wheat growth and yield components, i.e., plant height dry weight/plant, number of spikes/m^2, number of grains/spike and 1000-grain weight. As for the organic sources, the results show that the addition of compost had a slightly insignificant increasing in all studied growth and yield components of wheat when compared to the addition of farmyard manure in both seasons, except 1000-grain weight, which did not affect. It is worthy to notice that treated wheat plants with FYM or compost enhanced wheat growth and yield components than the plants without organic manuring. The positive effect of organic manure on wheat growth is mainly due to its advantages, such as, the nutrient supply is more balanced, which help to keep plants healthy; it enhance soil biological activity; it increase the organic matter content of soil, therefore improving the exchange capacity of nutrients, increasing soil water retention, promoting the soil aggregates and buffering soil against acidity and they release nutrients slowly and contribute to the residual pool organic N and P fixation, reducing N leaching loss and P fixation ,also supply micronutrients (Berger *et al* 2013). Similar results were obtained by Ali *et al* (2009) and Shah *et al* (2013) for farmyard manure, and Telep *et al* (2008) and Abbas *et al* (2012) for compost.

With regard to the levels of organic manure, the results clearly show that all studied wheat growth and yield components parameters except 1000-grain weight were responded to organic manure levels. Irrespective of the kind of organic manure, increasing organic levels up to 10 t/fed were significantly increased plant height, dry weight/plant, number of spikes /m^2 and number of grains/spike. The relative increasing of these parameters due to added 10 t/fed organic manure when compared with no manuring reached to about 11.0, 23.9, 13.2 and 8.6%, respectively in the first season. Similar trends were obtained in the second season. The increment in wheat growth and yield components could be explained as the advantages of organic manure as mentioned before. These results are in line with those obtained by El-Koumey (1998) and Abd El-Hafeez (2009).

Concerning the bio-fertilizer, the data reveal that bio-fertilizer application had markedly affect on all studied wheat growth and yield components, except 1000-grain wheat, which did not affect . Inoculated wheat plants with bio-fertilizer increased plant height, dry weight/plant, number of spikes/m^2 and number of grains/spike by about 3.2, 4.3, 1.0 and 2.1%, respectively in the first season when compared with no bio-fertilization . The corresponding increases in the second season were 2.0, 1.4, 1.1 and 2.0% in the abovementioned order. The positive affect of bio-fertilizer on wheat growth and yield components may be due to the bacterial inoculation was found to affect early plant and root development as well as nitrogen supply for plant (Dobbelaere *et al*, 2002). These results are in harmony with those obtained by Tantawey (2001) and Meawed and Gabriel (2002).

Table 3. Effect of organic manure sources and levels and bio-fertilizers on plant height, dry weight/plant and number of spikes/m^2.

Organic manure sources (A)	Organic manure levels (t/fed) (B)	Bio fertilizer (C)																	
		Plant height (cm)						Dry weight/plant (g)						Number of spikes/m^2					
		Seasons I			Seasons II			Seasons I			Seasons II			Seasons I			Seasons II		
		-	+	mean	-	+	mean	-	+	mean	-	+	mean	-	+	mean	-	+	mean
	0.0	90.2	95.3	92.8	90.1	94.5	92.3	1.82	1.93	1.88	1.97	1.90	1.94	301.2	305.7	303.5	300.7	305.0	302.9
FYM	5.0	96.1	97.5	96.8	95.6	96.9	96.3	2.01	2.15	2.08	1.99	2.10	2.05	325.6	331.4	328.5	323.1	329.7	326.4
	10.0	100.7	100.8	100.8	99.2	99.4	99.3	2.28	2.30	2.29	2.24	2.25	2.25	340.1	340.3	340.2	336.6	337.0	336.8
Mean		95.7	97.9	96.8	95.0	96.9	96.0	2.04	2.13	2.09	2.07	2.08	2.08	322.3	325.8	324.1	320.1	323.9	322.0
	0.0	90.2	95.3	92.8	90.1	94.5	92.3	1.82	1.93	1.88	1.79	1.90	1.85	301.2	305.7	303.5	300.7	305.0	302.9
Compost	5.0	93.1	99.9	96.5	97.7	98.8	98.3	2.13	2.25	2.19	2.10	2.12	2.11	330.7	335.5	333.1	328.4	333.1	330.8
	10.0	104.2	104.3	104.3	103.3	103.4	103.4	2.36	2.38	2.37	2.30	2.31	2.31	346.6	346.7	346.7	340.1	340.2	340.2
Mean		95.8	99.8	97.8	97.0	98.9	98.0	2.10	2.19	2.15	2.06	2.11	2.09	326.2	329.3	327.7	323.1	326.1	324.6
mean of	0.0	90.2	95.3	92.8	90.1	94.5	92.3	1.82	1.93	1.88	1.88	1.90	1.89	301.2	305.7	303.5	300.7	305.0	302.9
organic	5.0	94.6	98.7	96.7	96.7	97.9	97.3	2.07	2.20	2.14	2.05	2.11	2.08	328.2	333.5	330.8	325.8	331.4	328.6
levels	10.0	102.0	103.0	103	101.0	101.0	101.0	2.32	2.34	2.33	2.27	2.28	2.28	343.4	343.5	343.5	338.4	338.6	338.5
mean of	-			95.8			96.0			2.07			2.07			324.3			321.6
bio-fertilizer	+			98.9			97.9			2.16			2.10			327.6			325.0
L.S.D at 0.05																			
A				N.S			N.S			N.S			N.S			N.S			N.S
B				1.11			1.30			0.15			0.13			5.25			6.03
C				1.03			1.00			0.07			0.06			1.65			1.72
AB				N.S			N.S			N.S			N.S			N.S			N.S
AC				N.S			N.S			N.S			N.S			N.S			N.S
BC				N.S			N.S			N.S			N.S			N.S			N.S
ABC				N.S			N.S			N.S			N.S			N.S			N.S

(-): without bio-fertilizer (+): with bio-fertilizer

Table 4. Effect of organic manure sources and levels and bio-fertilizers on number of grains/spike, 1000-grain weight. and grain and straw yields.

Organic manure sources (A)	Organic Manure levels (t/fed) (B)	Bio-fertilize (C)																					
		Number of grains/spike						1000-grain weight (g)						Grain yield (ardab/fed)						Straw yield (t/fed)			
		Seasons I			Seasons II			Seasons I			Seasons II			Seasons I			Seasons II			Seasons I			Seasons II	
		-	+	mean	-	+	Mean	-	+	mean	-	+	mean	-	+	mean	-	+	mean	-	+	Mean	-	+	mean
	0.0	80.3	82.7	81.5	80.1	82.5	81.3	49.1	49.1	49.1	49.0	49.0	49.0	17.5	19.6	18.6	16.9	18.9	17.9	5.3	5.9	5.6	5.1	5.7	5.4
FYM	5.0	83.5	86.6	85.1	83.1	86.2	84.7	49.0	49.1	49.1	48.9	49.1	49.0	21.1	22.3	21.7	20.8	21.9	21.4	6.3	7.0	6.7	6.4	6.8	6.6
	10.0	87.1	87.3	87.2	86.8	87.0	86.9	49.1	49.1	49.1	49.0	49.0	49.0	24.4	24.6	24.5	23.6	23.7	23.7	7.9	7.9	7.9	7.7	7.8	7.8
Mean		83.6	85.5	84.6	83.3	85.2	84.28	49.1	49.1	49.1	49.0	49.0	49.0	21.0	22.2	21.6	20.4	21.5	21.0	6.5	6.9	6.7	6.4	6.8	6.6
	0.0	80.3	82.7	81.5	80.1	82.5	81.3	49.1	49.1	49.1	49.0	49.0	49.0	17.5	19.6	18.6	16.9	18.9	17.9	5.3	5.9	5.6	5.1	5.7	5.4
Compost	5.0	85.1	87.3	86.2	84.7	87.0	85.9	49.1	49.0	49.1	49.1	49.1	49.1	21.8	22.9	22.4	21.1	22.2	21.7	6.6	7.2	6.9	6.8	7.4	7.1
	10.0	89.7	89.9	89.8	88.5	88.6	88.6	49.1	49.1	49.1	49.0	49.1	49.1	26.1	26.3	26.2	24.8	24.9	24.9	8.1	8.2	8.2	8.3	8.4	8.4
Mean		85.0	86.6	85.8	84.4	86.0	85.2	49.1	49.1	49.1	49.0	49.1	49.1	21.8	22.9	22.4	20.9	22.0	21.5	6.7	7.1	6.9	6.7	7.2	7.0
mean of	0.0	80.3	82.7	81.5	80.1	82.5	81.3	49.1	49.1	49.1	49.0	49.0	49.0	17.5	19.6	18.6	16.9	18.9	17.9	5.3	5.9	5.6	5.1	5.7	5.4
organic	5.0	84.3	87.0	85.7	83.9	86.6	85.3	49.1	49.1	49.1	49.0	49.1	49.1	21.5	22.6	22.1	21.0	22.1	21.6	6.5	7.1	6.8	6.6	7.1	6.9
levels	10.0	88.4	88.6	88.5	87.7	87.8	87.8	49.1	49.1	49.1	49.0	49.1	49.1	22.3	25.5	25.4	24.2	24.3	24.3	8.0	8.1	8.1	8.0	8.1	8.1
mean of bio-fertilizer	-			84.3			83.9			49.1			49.0			21.4			20.7			6.6			6.6
	+			86.1			85.6			49.1			49.1			22.6			21.8			7.0			7.0
L.S.D at 0.05																									
A				N.S			N.S			N.S			N.S			N.S			N.S			N.S			N.S
B				1.35			1.76			N.S			N.S			1.35			1.16			0.33			0.42
C				1.28			1.33			N.S			N.S			0.56			0.61			0.10			0.11
AB				N.S			N.S			N.S			N.S			N.S			N.S			N.S			N.S
AC				N.S			N.S			N.S			N.S			N.S			N.S			N.S			N.S
BC				N.S			N.S			N.S			N.S			N.S			N.S			N.S			N.S
ABC				N.S			N.S			N.S			N.S			N.S			N.S			N.S			N.S

(-): without bio-fertilizer (+): with bio-fertilizer

With regard to the interaction effect, the results clearly show that all studied wheat growth and yield components did not affect by the interaction between treatments. In general, the highest values of growth and yield components parameters were obtained for wheat plants which received 10 t/fed compost and inoculated with bio-fertilizer. Whereas, the plants without both manuring and bio-fertilization exhibited the lowest wheat growth and yield components.

Grain and straw yields:

The data in Table 4 show the effect of organic manure sources and levels and bio-fertilization on grain and straw yields of wheat plants.

Regarding the affect of organic sources, the data reveal that the effect of compost on grain and straw yields was slightly surpassed the effect of farmyard manure. The differences between the effect of compost and FYM on wheat yields were not reached to the significants value on both grain and straw yields. The superiority of the effect of compost or FYM on grain yield reached to 20.4 and 16.1% when compared with zero manuring level, respectively in the first season. The corresponding increases for the straw yield were 23.2 and 19.6% in the same respect. The same trends were obtained in the second season. The promotive effect of compost or FYM is meanly due to its effects on wheat growth and yield component as mentioned before. Similar results were obtained by Abbas *et al* (2012) and Mohamed *et al* (2008).

With regard to the level of organic manure, the results clearly reveal that grain and straw yields were significantly affected by the levels of organic manure. Irrespective of organic manure sources, addition of 0.0, 5.0 and 10.0 t/fed organic manure yielded 18.6, 22.1 and 25.4 ardab/fed wheat grains and 5.6, 6.8, and 8.1 t straw/fed in the first season. Similar trends were obtained in the second season. Grain and straw yields due to 10.0 t/fed organic manure exceeded that due to without manuring by about 6.8 ardab and 2.5 t/fed in the first season, and 6.4 ardab and 2.7 t/fed in the second one, respectively. The increment in grain and straw yields as affected by increasing organic manure levels is mainly explained the effect of organic manure levels on wheat growth and yield components as discussed before. These results are similar to those obtained by El-Koumey (1998) and Abd El-Hafeez (2009).

Regarding bio-fertilization, the results show that inoculated wheat plants with bio-fertilizer resulted in significant increasing in both grain and straw yields. The relative increasing in grain and straw yields caused by bio-fertilization reached to 5.6 and 6.1% in the first season and 5.3 and 6.1% in the second one over without manuring, respectively. The enhancement of bio-fertilizer on grain and straw yields could be explained by its effect on growth and yield components of wheat as mentioned before. These results agree with those obtained by Rashid *et al* (1998) and Ismail *et al* (2014).

As for the interaction, the results show that both grain and straw yields were not responded to the interactions between treatments or among them. In general, the highest values of grain and straw yields were obtained under 10 t/fed compost + bio-fertilizer. On the other hand, the plants without manuring and bio-fertilization exerted the lowest grain and straw yields.

Nutrient uptake:

The results tabulated in Tables 5, 6 and 7 shows the affect of manuring and bio-fertilization on N, P and K uptake in grains and/or straw. As for the organic sources, it is evident that N, P and K uptake were significantly affected by organic sources. It is clear that compost gave the higher nutrient uptake than FYM in both seasons. Wheat plants treated with compost absorbed N, P and K in grains + straw supposed that due to FYM by about 5.9, 6.8 and 6.4%, respectively in the first season. Same trends were obtained in the second season. The superiority of compost than FYM on N, P and K uptake is mainly due to its high content of N, P and K than FYM (see Table 2). Moreover, addition of compost or FYM enhance nutrient uptake over no manuring. The relative increasing in total N, P and K due to compost or FYM reached to 34.7, 27.2; 45.5, 36.3 and 38.4, 30.1% as comparing with without manuring in the first season, respectively. The same trends were obtained in the second season. Similar results were obtained by El-Shabrawy (2011) and Abd- El lattif (2012).

Table 5. Effect of organic manure sources and levels and bio-fertilizers on N, P and K uptake (kg/fed) in wheat grains.

Organic manure sources (A)	Organic manure levels (t/fed) (B)	Bio fertilizer (C)																	
		N uptake (kg/fed)						P uptake (kg/fed)						K uptake (kg/fed)					
		Seasons I			Seasons II			Seasons I			Seasons II			Seasons I			Seasons II		
		-	+	mean	-	+	mean	-	+	mean	-	+	mean	-	+	Mean	-	+	Mean
FYM	0.0	32.81	36.75	34.78	32.19	36.00	34.10	9.23	10.31	9.77	9.09	10.17	9.63	15.18	17.03	16.11	14.93	16.69	15.81
	5.0	41.15	43.49	42.32	41.50	43.69	42.60	12.08	12.69	12.39	12.49	13.19	12.84	19.93	21.10	20.52	19.98	21.05	20.52
	10.0	49.41	49.82	49.62	48.85	49.41	49.13	15.33	15.53	15.43	15.17	15.57	15.37	24.19	24.31	24.25	24.09	24.51	24.30
Mean		41.12	43.35	42.24	40.85	43.03	41.94	12.18	12.82	12.50	12.25	12.98	12.62	19.78	20.81	20.30	19.67	20.75	20.21
Compost	0.0	32.81	36.75	34.78	32.19	36.00	34.10	9.23	10.31	9.77	9.09	10.17	9.63	15.18	17.03	16.11	14.93	16.69	15.81
	5.0	45.45	47.75	46.60	44.63	46.95	45.79	12.71	13.38	13.05	12.96	13.69	13.33	22.87	24.09	23.48	22.51	23.67	23.09
	10.0	56.38	57.20	56.79	54.68	54.90	54.79	16.79	16.92	16.86	16.77	16.78	16.78	29.79	30.36	30.08	28.62	29.17	28.90
Mean		44.88	47.23	46.06	43.83	45.95	44.89	12.91	13.54	13.22	12.94	13.55	13.24	22.61	23.83	23.22	22.02	23.18	22.60
mean of organic levels	0.0	32.81	36.75	34.78	32.19	36.00	34.10	9.18	10.27	9.73	9.10	10.18	9.64	15.20	17.02	16.11	14.93	16.70	15.82
	5.0	43.30	45.62	44.46	43.07	45.32	44.20	12.40	13.04	12.72	12.73	13.44	13.09	21.40	22.60	22.00	21.25	22.36	21.81
	10.0	52.90	53.51	53.21	51.77	52.16	51.96	16.06	16.23	16.15	15.97	16.18	16.08	26.99	27.34	27.17	26.36	26.84	26.60
mean of bio-fertilizer	-			43.00			42.34			12.55			12.60			21.20			20.85
	+			45.29			44.49			13.18			13.27			22.32			21.41
L.S.D at 0.05																			
A				1.15			1.27			0.36			0.30			0.78			0.81
B				0.73			0.61			0.33			0.41			0.66			0.73
C				0.86			0.78			0.45			0.55			0.61			0.63
AB				N.S			N.S			N.S			N.S			N.S			N.S
AC				N.S			N.S			N.S			N.S			N.S			N.S
ABC				N.S			N.S			N.S			N.S			N.S			N.S

(-): without bio-fertilizer (+): with bio-fertilizer

Considering the organic manure levels, the results show that, irrespective of organic sources, increasing organic manure levels resulted in significant increasing in N, P and K uptake in grains and/or straw. The plants fertilized with 0.0, 5.0 and 10.0 t/fed organic manure absorbed 52.11, 68.48 and 84.12; 15.83, 21.87 and 29.35 and 83.35, 112.8 and 139.54 kg fed^{-1} total N, P and K in the first season. The corresponding values for the second season were 51.34, 69.52 and 84.49; 16.11, 23.18 and 29.24 and 80.60, 113.65 and 140.16 kg fed^{-1} in the same respect. It is obvious to notice that the increase in N, P and K uptake were proportional to the increase in both grain and straw yields (Table 4), which nutrient uptake is calculated as multiplying yields × nutrient concentration (see appendix). In this connection, Makail *et al* (2006) mentioned that organic manure contains sufficient amounts of most plant nutrients which release in available form upon its decomposition. These results are similar to obtained by Karki *et al* (2005) and Abd-El lattif (2012).

Table 6. Effect of organic manure sources and levels and bio-fertilizers on N, P and K uptake (kg/fed) in wheat straw.

Organic manure sources (A)	Organic manure levels (t/fed)(B)	Bio fertilizer (C)																	
		N uptake (kg/fed)						P uptake (kg/fed)						K uptake (kg/fed)					
		Seasons I			Seasons II			Seasons I			Seasons II			Seasons I			Seasons II		
		-	+	mean	-	+	mean	-	+	mean	-	+	Mean	-	+	mean	-	+	mean
FYM	0.0	16.41	18.28	17.35	16.29	18.20	17.25	5.81	6.47	6.14	6.11	6.87	6.49	63.63	70.78	67.21	61.17	68.43	64.80
	5.0	22.71	25.17	23.94	24.35	25.82	25.09	8.21	9.08	8.65	8.93	10.19	9.56	83.14	93.11	88.13	84.51	90.47	87.49
	10.0	30.83	30.79	30.81	32.31	33.55	32.93	12.61	12.61	12.61	10.75	10.95	10.85	109.05	109.00	109.03	107.01	108.39	107.70
Mean		23.31	24.76	24.03	24.32	25.86	25.09	8.88	9.40	9.14	8.61	9.32	8.96	85.27	90.98	88.13	84.23	89.08	86.66
Compost	0.0	16.41	18.28	17.35	16.29	18.20	17.25	5.81	6.47	6.14	6.11	6.87	6.49	63.63	70.78	67.21	61.17	68.43	64.80
	5.0	23.07	25.19	24.13	24.51	26.67	25.59	9.27	10.11	9.69	10.17	11.08	10.63	89.05	97.95	93.50	91.83	100.61	96.22
	10.0	30.81	31.19	31.00	31.51	32.73	32.12	13.75	13.91	13.83	14.97	15.95	15.46	115.05	116.41	115.73	118.67	120.08	119.38
Mean		23.43	24.89	24.16	24.10	25.87	24.99	9.61	10.16	9.89	10.42	11.30	10.86	89.24	95.05	92.15	90.56	96.37	93.47
mean of organic levels	0.0	16.40	18.30	17.35	16.29	18.21	17.25	5.81	6.49	6.15	6.13	6.84	6.49	63.63	70.81	67.22	61.17	68.41	64.79
	5.0	22.89	25.18	24.04	24.43	26.25	25.34	8.74	9.60	9.17	9.55	10.64	10.10	86.10	95.53	90.82	88.17	95.54	91.86
	10.0	30.82	30.99	30.91	31.91	33.14	32.53	13.18	13.26	13.22	12.86	13.45	13.16	112.05	112.71	112.38	112.84	114.24	113.54
mean of bio-fertilizer	-			23.37			24.21			9.25			9.52			87.26			87.40
	+			24.83			25.87			9.78			10.31			93.02			92.73
L.S.D at 0.05																			
A				0.85			0.73			0.22			0.30			1.71			1.68
B				0.60			0.67			0.20			0.25			0.95			0.89
C				0.71			0.75			0.31			0.36			0.86			0.93
AB				N.S			N.S			N.S			N.S			N.S			N.S
AC				N.S			N.S			N.S			N.S			N.S			N.S
ABC				N.S			N.S			N.S			N.S			N.S			N.S

(-): without bio-fertilizer (+): with bio-fertilizer

Table 7. Effect of organic manure sources and levels and bio-fertilizers on total N, P and K uptake (kg/fed).

Organic manure sources (A)	Organic manure levels (t/fed) (B)	Bio fertilizer (C)																	
		Total N uptake (kg/fed)						Total P uptake (kg/fed)						Total K uptake (kg/fed)					
		Seasons I			Seasons II			Seasons I			Seasons II			Seasons I			Seasons II		
		-	+	mean	-	+	mean	-	+	mean	-	+	mean	-	+	mean	-	+	mean
FYM	0.0	49.20	55.01	52.11	48.51	54.19	51.35	15.01	16.75	15.88	15.23	17.00	16.12	78.83	87.87	83.35	76.09	85.11	80.60
	5.0	63.89	68.63	66.26	65.87	69.50	67.69	20.31	21.79	21.05	21.40	23.41	22.41	103.09	114.19	108.64	104.51	111.47	107.99
	10.0	80.20	80.66	80.43	81.13	82.99	82.06	27.92	28.17	28.05	25.97	26.50	26.24	133.22	133.30	133.26	131.13	132.88	132.01
Mean		64.42	68.11	66.26	65.15	68.89	67.02	21.05	22.22	21.64	20.86	22.29	21.58	105.04	111.79	108.41	103.90	109.82	106.86
Compost	0.0	49.20	55.01	52.11	48.51	54.19	51.35	15.01	16.75	15.88	15.23	17.00	16.12	78.83	87.87	83.35	76.09	85.11	80.60
	5.0	68.49	72.91	70.70	69.11	73.59	71.35	21.93	23.45	22.69	23.11	24.79	23.95	111.90	122.00	116.95	114.36	124.25	119.31
	10.0	87.21	88.41	87.81	86.17	87.65	86.91	30.59	30.87	30.73	31.75	32.71	32.23	144.87	146.75	145.81	147.31	149.28	148.30
Mean		68.30	72.11	70.21	67.93	71.81	69.87	22.51	23.69	23.10	23.36	24.83	24.10	111.87	118.87	115.37	112.59	119.55	116.07
mean of organic levels	0.0	49.19	55.02	52.11	48.48	54.19	51.34	14.96	16.73	15.85	15.22	16.99	16.11	78.82	87.87	83.35	76.08	85.11	80.60
	5.0	66.19	70.77	68.48	67.49	71.55	69.52	21.12	22.62	21.87	22.26	24.10	23.18	107.50	118.10	112.80	109.44	117.86	113.65
	10.0	83.71	84.54	84.12	83.65	85.32	84.49	29.26	29.52	29.39	28.86	29.61	29.24	139.05	140.03	139.54	139.22	141.08	140.16
mean of bio-fertilizer	-			66.36			66.54			21.78			22.11			108.46			108.25
	+			70.11			70.35			22.96			23.56			115.33			114.69
L.S.D at 0.05																			
A				2.01			1.93			0.51			0.59			1.85			1.89
B				1.67			1.50			0.43			0.50			1.03			1.16
C				1.82			1.63			0.45			0.52			1.27			1.38
AB				N.S			N.S			N.S			N.S			N.S			N.S
AC				N.S			N.S			N.S			N.S			N.S			N.S
ABC				N.S			N.S			N.S			N.S			N.S			N.S

(-): without bio-fertilizer (+): with bio-fertilizer

Regarding the bio-fertilizer effect, the results clearly reveal that N, P and K uptake in wheat grains and/or straw were significantly affected by bio-fertilization. Inoculated wheat plants with bio-fertilizer improved total N, P and K uptake by about 5.7, 5. 4 and 6.3% when compared with no bio-fertilization, respectively in the first season. Same trends were obtained in the second season. These increments, may be related to early bacterial activity, which can encourage root development and plant features (Volpin and Kapulnic, 1994). Also, Molla *et al* (2001) mentioned that cells of bacteria might have contained some compounds that could induce new root hair formation and subsequent enhancing nutrient absorption. These results are in line with those obtained by Abdul Jabbar and Saud (2010) and Yu *et al* (2012).

As for the interactions between treatments, the data clearly show that N, P and K uptake were not affected by the interaction between any two factors or among the three factors. In general, the plants inoculated with bio-fertilizer and treated with 10 t/fed compost adsorbed highest N, P and K in its grains and/or straw. Whereas, the plants without manuring and bio-fertilization recorded the lowest N, P and K uptake.

Soil properties:

The data concerning soil properties, namely, soil reaction (pH), soil salinity (EC) and soil organic matter after wheat harvest as affected by organic sources and levels and bio-fertilization are given in Table 8. As for organic sources, the results show that both soil pH and EC did not changed by the organic sources, while compost application resulted in soil organic matter (1.65 and 1.63% in both seasons, respectively) higher than that due to FMY (1.60 and 1.58 % in the two seasons ,respectively). This mainly due to the higher content of organic matter in compost than FYM (Table 2). It is obvious to notice that, both compost and FYM increased soil salinity and soil organic matter when compared to without manuring, while soil pH decreased as compost or FYM application over with no manure. Similar results were obtained by Abd-El lattif (2012).

Table 8. Effect of organic manure sources and levels and bio-fertilizers on some soil properties after wheat harvest.

Organic manure sources (A)	Organic manure levels (t/fed) (B)	Bio fertilizer (C)																	
		pH						EC (dsm-1)						O.M (%)					
		Seasons I			Seasons II			Seasons I			Seasons II			Seasons I			Seasons II		
		-	+	mean	-	+	Mean	-	+	Mean	-	+	mean	-	+	mean	-	+	mean
FYM	0.0	8.13	8.15	8.14	8.11	8.11	8.11	1.23	1.23	1.23	1.17	1.17	1.17	1.41	1.42	1.42	1.38	1.38	1.38
	5.0	8.04	8.04	8.04	8.02	8.02	8.02	1.35	1.35	1.35	1.36	1.36	1.36	1.61	1.62	1.62	1.60	1.60	1.60
	10.0	7.92	7.93	7.93	7.90	7.91	7.91	1.52	1.51	1.52	1.53	1.53	1.53	1.77	1.76	1.77	1.75	1.74	1.75
Mean		8.03	8.04	8.04	8.01	8.01	8.01	1.37	1.36	1.37	1.35	1.35	1.35	1.60	1.60	1.60	1.58	1.57	1.58
Compost	0.0	8.13	8.15	8.14	8.11	8.11	8.11	1.23	1.23	1.23	1.17	1.17	1.17	1.41	1.42	1.42	1.38	1.38	1.38
	5.0	8.00	8.00	8.00	8.00	8.01	8.01	1.32	1.32	1.32	1.30	1.30	1.30	1.73	1.73	1.73	1.72	1.71	1.72
	10.0	7.86	7.86	7.86	7.85	7.85	7.85	1.46	1.46	1.46	1.42	1.42	1.42	1.79	1.79	1.79	1.78	1.78	1.78
Mean		8.00	8.00	8.00	7.99	7.99	7.99	1.34	1.34	1.34	1.30	1.30	1.30	1.64	1.65	1.65	1.63	1.62	1.63
mean of organic levels	0.0	8.13	8.15	8.14	8.11	8.11	8.11	1.23	1.23	1.23	1.17	1.17	1.17	1.41	1.42	1.42	1.38	1.38	1.38
	5.0	8.02	8.02	8.02	8.01	8.02	8.02	1.34	1.34	1.34	1.33	1.33	1.33	1.67	1.68	1.68	1.66	1.66	1.66
	10.0	7.89	7.90	7.90	7.88	7.88	7.88	1.49	1.49	1.49	1.48	1.48	1.48	1.78	1.78	1.78	1.77	1.76	1.77
mean of bio-fertilizer	-			8.02			8.00			1.36			1.33			1.62			1.61
	+			8.02			8.00			1.35			1.33			1.63			1.60
L.S.D at 0.05																			
A				N.S			N.S			N.S			N.S			0.06			0.05
B				0.03			0.03			0.02			0.03			0.04			0.05
C				N.S			N.S			N.S			N.S			N.S			N.S
AB				N.S			N.S			N.S			N.S			N.S			N.S
AC				N.S			N.S			N.S			N.S			N.S			N.S
ABC				N.S			N.S			N.S			N.S			N.S			N.S

Without bio-fertilizer (+): with bio-fertilizer

With respect to organic manure levels, the data clearly show that soil pH, EC and organic matter were significantly affected by manure levels. Irrespective of the kind of used organic manure ,increasing organic manure up to 10.0 t/fed had significantly increased soil salinity and soil organic matter, while soil reaction decreased. The reduction in pH values due to increasing organic manure levels could be ascribed to acidifying affect of organic acids produced during the course of continuous decomposition of applied manure. On the other hand, the increase in soil salinity and soil organic matter due to increasing organic manure levels may be due to its high salinity and organic matter content. Similar results were obtained by Taha (2007) and Ali (2009) for soil reaction, Sayed (2009), Abd El-Hafeez *et al* (2013), Abdel-Aal *et al* (2003) and Kundu *et al* (2006).

As for the effect of bio- fertilizer, the result clearly show that soil pH, EC and organic matter did not affected by bio-fertilization .The main values of pH, EC and O.M % in soil after wheat harvest due to without and with bio-fertilizer were 8.02 and 8.02; 1.36 and 1.35 dsm^{-1}; and 1.62% and 1.63% in the first season, respectively. The corresponding values for the second season were 8.00 and 8.00; 1.33 and 1.33 dsm^{-1}; and 1.61% and 1.60% in same order. Similar results were obtained by Ali *et al* (2009).

Regarding the interaction, the data reveal that soil pH, EC and organic matter did not affect by the interaction between any two factors or among the three factors. In general, the highest values of soil EC and organic matter and minimum values of soil reaction were recorded for the wheat plants treated with 10.0 t/fed of any organic sources. On the other hand, the treatment of without manuring gave the lowest soil salinity and soil organic matter and highest pH value, in both seasons.

Soil fertility:

Data presented in Table 9 show the affect of organic sources and levels as well as bio-fertilization on soil fertility in term of soil available N,P and K after wheat harvest. The results reveal that compost surpassed FYM in its affect on soil available N,P and K after harvest . The relative increasing of soil available N,P and K resulted to compost reached to 6.8,10.0 and 3.5% over the effect of FYM in the first season, respectively. Same trends were obtained in the second season. It is worthy to observed that both compost and FYM had a pronounced affect on increasing the nutrient availability when compared with no manuring. Irrespective, of manure levels, added compost or FYM enhanced soil available N, P and K after harvest by about 42.3 and 33.2 ; 30.0 and 18.2 ; and 9.3 and 5.6 % in the first season, respectively. Similar trends were obtained in the second season.The superiority of compost on improving soil available N, P and K is mainly due to its higher content of N,P and K than FYM, which could be produce higher N,P and K in soil during organic materials decomposition. Results are in harmony with those obtained by El-Sharawy *et al* (2003) for compost and Abd El-lattif (2012) for FYM.

Table 9. Effect of organic manure sources and levels and bio-fertilizers on soil fertility after wheat harvest.

Organic manure sources (A)	Organic manure levels (t/fed)(B)	Bio fertilizer (C)																	
		Available N (mg Kg^{-1})						Available P (mg Kg^{-1})						Available K (mg Kg^{-1})					
		Seasons I			Seasons II			Seasons I			Seasons II			Seasons I			Seasons II		
		-	+	mean	-	+	Mean	-	+	mean	-	+	mean	-	+	mean	-	+	mean
FYM	0.0	22.0	22.0	22.0	24.0	25.0	24.5	11.0	11.0	11.0	12.0	12.0	12.0	170.0	174.0	172.0	182.0	183.0	182.5
	5.0	30.0	30.0	30.0	32.0	32.0	32.0	13.0	13.0	13.0	14.0	14.0	14.0	182.0	183.0	182.5	195.0	193.0	194.0
	10.0	36.0	36.0	36.0	37.0	37.0	37.0	15.0	15.0	15.0	17.0	17.0	17.0	190.0	191.0	190.5	199.0	199.0	199.0
Mean		29.3	29.3	29.3	31.0	31.3	31.2	13.0	13.0	13.0	14.3	14.3	14.3	180.7	182.7	181.7	192.0	191.7	191.8
Compost	0.0	22.0	22.0	22.0	24.0	25.0	24.5	11.0	11.0	11.0	12.0	12.0	12.0	170.0	174.0	172.0	182.0	183.0	182.5
	5.0	33.0	33.0	33.0	35.0	35.0	35.0	15.0	15.0	15.0	16.0	16.0	16.0	191.0	191.0	191.0	197.0	197.0	197.0
	10.0	39.0	39.0	39.0	41.0	41.0	41.0	17.0	17.0	17.0	18.0	18.0	18.0	201.0	201.0	201.0	210.0	209.0	209.5
Mean		31.3	31.3	31.3	33.3	33.7	33.5	14.3	14.3	14.3	15.3	15.3	15.3	187.3	188.7	188.0	196.3	196.3	196.3
mean of organic levels	0.0	22.0	22.0	22.0	24.0	25.0	24.5	11.0	11.0	11.0	12.0	12.0	12.0	170.0	174.0	172.0	182.0	183.0	182.5
	5.0	31.5	31.5	31.5	33.5	33.5	33.5	14.0	14.0	14.0	15.0	15.0	15.0	186.5	187.0	186.8	196.0	195.0	195.5
	10.0	37.5	37.5	37.5	39.0	39.0	39.0	16.0	16.0	16.0	17.5	17.5	17.5	195.5	196.0	195.8	204.5	204.0	204.3
mean of bio-fertilizer	-			30.3			32.2			13.7			14.8			184.0			194.2
	+			30.3			32.5			13.7			14.8			185.7			194.0
L.S.D at 0.05																			
A				0.56			0.76			0.36			0.42			2.17			2.68
B				1.67			1.85			1.68			1.78			2.85			2.96
C				N.S			N.S			N.S			N.S			N.S			N.S
AB				N.S			N.S			N.S			N.S			N.S			N.S
AC				N.S			N.S			N.S			N.S			N.S			N.S
ABC				N.S			N.S			N.S			N.S			N.S			N.S

without bio-fertilizer (+): with bio-fertilizer

Regarding the organic manure levels, the results show that increasing manure level had a positive affect on soil available N, P and K. Increasing manure levels to 10.0 t/fed increased soil available N, P and K after harvest by about 70.5, 45.5 and 13.8% over no manuring in the first season, respectively. The corresponding values for the second season were 59.2, 45.8 and 11.9 % in the above mentioned order. This increment in soil available nutrients due to increasing manure levels is mainly due to the organic acids produced from manure decomposition caused a reduction in soil pH (see Table 8), consequently increased nutrients availability (Negm *et al*, 2002). Also, this increases may be due to the nutrient content in manure, which release during its composition in soluble form. These results are in line with those obtained by Awad-Alla (2007) and Ali *et al* (2012).

As for bio-fertilizer, the results clearly show that nutrient availability did not affect by bio-fertilization. The values of soil available N, P and K in soil after harvest due to with or without bio- fertilization were 30.3 and 30.3; 13.7 and 13.7; and 184.0 and 185.7 mg kg^{-1} in the first season, respectively. The corresponding values for the second season were 32.2 and 32.5; 14.8 and 14.8; and 194.2 and 194.0 mg Kg^{-1} in the same order. Similar results were obtained by Ali (2009).

Concerning the interaction, the results reveal that soil available N, P and K in soil after wheat harvest did not respond to the interactions between treatments, which means that each factor act at independently. In general, the highest values of soil available N, P and K in soil after harvest was produced under the treatment of 10 t compost /fed + with or without bio-fertilization. On the other hand, the treatment of without manurig + without bio-fertilization possessed the lowest soil available N, P and K after harvest.

CONCLUSION

It could be concluded that fertilized wheat plants with 10.0 t/fed compost or FYM plus inoculated wheat grains with bio-fertilizer before sowing resulted in maximum productivity of wheat as well as improving soil properties and soil fertility.

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APPENDIX

Table 1. Effect of organic manure sources and levels and bio-fertilizers on N, P and K concentration in wheat grains.

Organic manure sources (A)	Organic manure levels (t/fed) (B)	Bio fertilizer (C)																	
		N (%)						P (%)						K (%)					
		Seasons I			Seasons II			Seasons I			Seasons II			Seasons I			Seasons II		
		-	+	mean	-	+	mean	-	+	mean	-	+	mean	-	+	Mean	-	+	mean
FYM	0.0	1.25	1.25	1.25	1.27	1.27	1.27	0.35	0.35	0.35	0.36	0.36	0.36	0.58	0.58	0.58	0.59	0.59	0.59
	5.0	1.30	1.30	1.30	1.33	1.33	1.33	0.38	0.38	0.38	0.40	0.40	0.40	0.63	0.63	0.63	0.64	0.64	0.64
	10.0	1.35	1.35	1.35	1.38	1.39	1.39	0.42	0.42	0.42	0.43	0.44	0.44	0.66	0.66	0.66	0.68	0.69	0.69
Mean		1.30	1.30	1.30	1.33	1.33	1.33	0.38	0.38	0.38	0.40	0.40	0.40	0.62	0.62	0.62	0.64	0.64	0.64
Compost	0.0	1.25	1.25	1.25	1.27	1.27	1.27	0.35	0.35	0.35	0.36	0.36	0.36	0.58	0.58	0.58	0.59	0.59	0.59
	5.0	1.39	1.39	1.39	1.41	1.41	1.41	0.39	0.39	0.39	0.41	0.41	0.41	0.70	0.70	0.70	0.71	0.71	0.71
	10.0	1.44	1.45	1.45	1.47	1.47	1.47	0.43	0.43	0.43	0.45	0.45	0.45	0.76	0.77	0.77	0.77	0.78	0.78
Mean		1.36	1.36	1.36	1.38	1.38	1.38	0.39	0.39	0.39	0.41	0.41	0.41	0.68	0.68	0.68	0.69	0.69	0.69
mean of organic levels	0.0	1.25	1.25	1.25	1.27	1.27	1.27	0.35	0.35	0.35	0.36	0.36	0.36	0.58	0.58	0.58	0.59	0.59	0.59
	5.0	1.35	1.35	1.35	1.37	1.37	1.37	0.39	0.39	0.39	0.41	0.41	0.41	0.67	0.67	0.67	0.68	0.68	0.68
	10.0	1.40	1.40	1.40	1.43	1.43	1.43	0.43	0.43	0.43	0.44	0.45	0.45	0.71	0.72	0.72	0.73	0.74	0.74
mean of bio-fertilizer	-			1.33			1.36			0.39			0.41			0.65			0.67
	+			1.33			1.36			0.39			0.41			0.65			0.67
L.S.D at 0.05																			
A				0.03			0.02			N.S			N.S			0.02			0.03
B				0.05			0.03			0.03			0.04			0.06			0.04
C				N.S			N.S			N.S			N.S			N.S			N.S
AB				N.S			N.S			N.S			N.S			N.S			N.S
AC				N.S			N.S			N.S			N.S			N.S			N.S
ABC				N.S			N.S			N.S			N.S			N.S			N.S

Without bio-fertilizer (+): with bio-fertilizer

Table 2. Effect of organic manure sources and levels and bio-fertilizers on N, P and K concentration in wheat straw.

Organic manure sources (A)	Organic manure levels (t/fed) (B)	Bio fertilizer (C)																	
		N (%)						P (%)						K (%)					
		Seasons I			Seasons II			Seasons I			Seasons II			Seasons I			Seasons II		
		-	+	Mean	-	+	Mean	-	+	mean	-	+	Mean	-	+	Mean	-	+	mean
FYM	0.0	0.31	0.31	0.31	0.32	0.32	0.32	0.11	0.11	0.11	0.12	0.12	0.12	1.20	1.20	1.20	1.20	1.20	1.20
	5.0	0.36	0.36	0.36	0.38	0.38	0.38	0.13	0.13	0.13	0.14	0.15	0.15	1.32	1.33	1.33	1.32	1.33	1.33
	10.0	0.39	0.39	0.39	0.42	0.43	0.43	0.16	0.16	0.16	0.14	0.14	0.14	1.38	1.38	1.38	1.39	1.39	1.39
Mean		0.35	0.35	0.35	0.37	0.38	0.38	0.13	0.13	0.13	0.13	0.14	0.14	1.30	1.30	1.30	1.30	1.31	1.31
Compost	0.0	0.31	0.31	0.31	0.32	0.32	0.32	0.11	0.11	0.11	0.12	0.12	0.12	1.20	1.20	1.20	1.20	1.20	1.20
	5.0	0.35	0.35	0.35	0.36	0.36	0.36	0.14	0.14	0.14	0.15	0.15	0.15	1.35	1.36	1.36	1.35	1.36	1.36
	10.0	0.38	0.38	0.38	0.38	0.39	0.39	0.17	0.17	0.17	0.18	0.19	0.19	1.42	1.42	1.42	1.43	1.43	1.43
Mean		0.35	0.35	0.35	0.35	0.36	0.36	0.14	0.14	0.14	0.15	0.15	0.15	1.32	1.33	1.33	1.33	1.33	1.33
mean of organic levels	0.0	0.31	0.31	0.31	0.32	0.32	0.32	0.11	0.11	0.11	0.12	0.12	0.12	1.20	1.20	1.20	1.20	1.20	1.20
	5.0	0.36	0.36	0.36	0.37	0.37	0.37	0.14	0.14	0.14	0.15	0.15	0.15	1.34	1.35	1.35	1.34	1.35	1.35
	10.0	0.39	0.39	0.39	0.40	0.41	0.41	0.17	0.17	0.17	0.16	0.17	0.17	1.40	1.40	1.40	1.41	1.41	1.41
mean of bio-fertilizer	-			0.35			0.36			0.14			0.14			1.31			
	+			0.35			0.37			0.14			0.15			1.32			
L.S.D at 0.05																			
A				N.S			N.S			N.S			N.S			0.01			0.01
B				0.03			0.02			0.02			0.01			0.04			0.03
C				N.S			N.S			N.S			N.S			N.S			N.S
AB				N.S			N.S			N.S			N.S			N.S			N.S
AC				N.S			N.S			N.S			N.S			N.S			N.S
ABC				N.S			N.S			N.S			N.S			N.S			N.S

- **without bio-fertilizer**
- **(+): with bio-fertilizer**

تأثير مصادر ومستويات مختلفة من التسميد العضوى والحيوى على إنتاجية القمح وخواص التربة وخصوبتها

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أجريت تجربتان حقليتان بالمزرعة البحثية بمحطة البحوث الزراعية بسدس /مركز البحوث الزراعية /محافظة بنى سويف خلال موسمى النمو 2016/ 2017، 2017 / 2018 لدراسة تاثير مصادر من الأسمدة العضوية (كمبوست وسماد بلدى) بمستويات مختلفة (صفر ،5، 10 طن سماد /فدان) وكذلك التسميد الحيوى (تسميد حيوى ، بدون تسميد حيوى) على صفات النمو (طول النبات ، والوزن الجاف للنبات) ، صفات مكونات المحصول (عدد السنابل / م^2، عدد الحبوب / السنبلة و وزن الألف حبة) ومحصول الحبوب والقش وأمتصاص عناصر النيتروجين والفسفور والبوتاسيوم فى الحبوب والقش وبعض خصائص التربة بعد الحصاد (الحموضة ، الملوحة ، نسبة المادة العضوية) وخصوبة التربة (النيتروجين والفسفور والبوتاسيوم الصالح فى التربة بعد الحصاد) وكان أهم النتائج المتحصل عليها هى: - أدى إضافة الكمبوست إلي زيادة قليلة نسبيا على إنتاجية القمح وخواص التربة وخصوبتها مقارنة بإضافة السماد البلدى. -أدت زيادة معدلات التسميد العضوى إلى زيادة معنوية لكل من صفات النمو والمحصول ومكوناتة وامتصاص العناصر ماعدا وزن الألف حبة التى لم تتأثر ، كما أدى زيادة معدلات التسميد العضوى لتحسين خواص التربة وخصوبتها ما عدا الملوحة التى زادت بزيادة التسميد العضوى. - أدى التسميد الحيوى إلى زيادة صفات النمو والمحصول ومكوناته وامتصاص العناصر ، ماعدا وزن الألف حبة التى لم تتأثر ، ولم يؤثر التسميد الحيوى على صفات التربة وخصوبتها بعد الحصاد. من نتائج الدراسة يمكن التوصية بتسميد القمح بالأسمدة العضوية سواء كمبوست أو سماد بلدى بمعدل 10 طن /فدان لزيادة انتاجية القمح وتحسين خواص التربة وخصوبتها.