J. Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 10 (2): 99 - 105, 2019

Yield and Nutrient Concentrations of Wheat Plants as Affected by the Interaction between Organic Manuers , Phosphorus and Potassium Fertilizers

El-Hamdi, Kh. H. ; M. M. Omar and Mona A. El-Gendy
Soils Dept., Fac. of Agriculture, Mansoura Univ., Egypt.

ABSTRACT

During the winter seasons of 2015/2016 and 2016/2017, at the Experimental Farm of the Faculty of Agriculture, Mansoura University, Egypt, a pot experiment was laid out in a clayey soil, to study the effects of organic manure, chemical fertilization levels as (phosphorus and potassium) and their interactions on yield and yield component and chemical composition, of wheat (*Triticum aestivum* L.) plants. Twenty seven treatments were arranged in a split-split plot design with three replicates, which were the simple combination of three treatments of organic manures (control, rice straw compost and chicken manure) as main plots, three rates of phosphorus fertilization (0, 50 and 100% of the RD.) as sub plots and three rates of potassium fertilization (0, 50 and 100% of the RD.) as sub sub plots. Thus, the total number of the experimental pots was 81 pots. The application of rice straw compost and chicken manure significantly increased the mean values of grains per spike, spike length (cm), weight of 1000 grains, as well as grain and straw yields (g pot^{-1}) of wheat plants as compared with the control treatment. On other words; rice straw compost was the most effective treatment in improving quantitative yield and nutrient concentrations. Application of phosphorus fertilization significantly increased all parameters under study for the plants treated with both rates over that obtained from the untreated plants. In this respect; the highest values were realized from the treatment of 100% P-fertilization.Adding potassium fertilization at 100% of the recommended dose to wheat plants achieved the highest values for all traits as compared to the untreated plants.The obtained results revealed that the integrated treatment of rice straw compost + 100% P and K fertilizations produced the highest values of yield and its components of wheat plants throughout all growth stages during both seasons. N, P and K concentrations in the dry matter of wheat plants were also improved due.

Keywords: Organic manures, phosphorus fertilization, potassium fertilization and wheat plant.

INTRODUCTION

Adding soil organic manures is a suitable way for beneficent soil properties by providing a suitable soil structure, increasing cation exchange capacity, increasing the availability and quality of plant elements and providing the substrate of microbial activities. In agriculture using of organic fertilization is openly practiced in Egypt. Thus, the recycling farm wastes technology, mostly wide C/N ratio materials, under intensive cropping system should be developed to increment the crop yield and to protect soil fertility level (El-Etr *et al.,* 2004). In integrated nutrient management system, the nutrient needs of plants have to be met through organic sources application. compost rice straw and chicken manure in coupling with mineral fertilizers. Many researches have explained the useful effect of combined use of organic and chemical fertilizers to relieve the deficiency of many secondary and micronutrients, in filed that constantly received only N, P and K fertilizers (Dhaliwal *et al*., 2012 and Ahmad, 2013).

Using of organic and chemical fertilizers together had a big positive effect on microbial biomass so, hence soil health. Kaur *et al*., (2005) declared that balanced fertilization using both chemical and organic fertilizers is remarkable for maintenance of soil organic matter content and long term soil productivity in the tropics where soil organic matter content is low.

Phosphorus is the essential plant nutrient which plays major role for achieving the maximum agricultural production. After stress of nitrogen, phosphorus considered the second most extensively occurring nutrient deficiency, in cereal chain across the world. Phosphorus use efficiency (PUE) of crops ranged from 10-30%. Many researchers had obtained significantly maximum yield of grain in with optimum use of P fertilizer (Arshad *et al*., 2016). P are utilized to the soil in the form of both fertilizers (Organic and inorganic sources) when available P is less than crop's requirement. On the other hand, phosphorus plays a key role in metabolic process like the conversion of sugar into cellulose and starch. As a result, phosphorus deficiency causes stunting, shriveled seeds and delayed maturity. P-availability for plants is improved by organic amendments. According to wheat crop, addition of phosphorus at the rate of 100 kg ha^{-1} through double band placement significantly ($P<0.05$) increased plant height, grains $spike^{-1}$, productive tillers m^{-2}, 1000 grain weight, grain yield, biological yield, harvest index and agronomic phosphorus efficiency of wheat crop and reduced nonproductive tillers m^{-2} compared with other treatments (Saqib Bashir *et al.,* 2015).

Potassium (K) is the third most important macronutrient required for plant growth, after nitrogen (N) and phosphorus (P), it considered one of the basis plant nutrients underpinning crop yield quality determination and production. Potassium is usually found in plants at levels above all other macronutrients except oxygen, carbon, occasionally nitrogen and hydrogen (Soil Quality Organization, SQO, 2015). As K is interested in many physiological processes, its impact on photosynthesis, water relations, enzyme activation and assimilate transport can have direct consequences on productivity of crop (Pettigrew, 2008) by regulating the opening and closing of stomata and therefore regulating moisture loss from the plant. For this reason, K is colloquially known as "poor-man's irrigation" because it assists crops to achieve yields more effectively (SQO, 2015). The requirement for K varies from plant to plant and from species to species. For example, wheat requires K for optimal growth and development while adequate K results in superior quality of the whole plant due to increased resistance to some diseases, improved photosynthetic efficiency, greater water use efficiency, and helps to maintain a normal balance between proteins and carbohydrates. Sufficient K results in stronger wheat straw and assists in grain filling (Agri-News, 2012).

The need of potassium fertilizers are increasing when agriculture is intensified. Thus, the intensive and continued cropping of Egyptian soils have greatly reduced the level of available potassium in the soil; now a days insufficient Soil K level is usually corrected by adding K- fertilizers in order to maintain the fertility level of Egyptian soils. It was recorded that each of potassium fertilization resulted in a significant increase in N uptake by the grain and grain K

concentration (Sobh *et al.,* 2000). Phosphorus and potassium in both grain and straw of wheat plant responded significantly to all K fertilizer treatments (El-Beyali *et al*., 2001).

Investigation under study is laid out to study the effects of some organic manures, mineral fertilization levels as (phosphorus and potassium), and their interaction on growth parameters, chemical content, yield and its component of wheat plant.

MATERIALS AND METHODS

During the winter seasons of 2015/2016 and 2016/2017, at the Experimental Farm of the Faculty of Agriculture, Mansoura University, Egypt (30.04 N latitude and 31.35 E longitude), a pot experiment was laid out to investigate the effect of organic manures, mineral fertilization levels as (phosphorus and potassium) and their interaction on yield and yield component and chemical composition of wheat (*Triticum aestivum* L.) plants.

Twenty-seven treatments were arranged in a split-split plot design with three replicates which were the simple combination of three treatments of organic manures (control, rice straw compost and chicken manure) as main plots, three rates of phosphorus fertilization (0, 50 and 100% of the recommended dose) as sub plots and three rates of potassium fertilization (0, 50 and 100% of the recommended dose) as sub sub plots. Thus, the total number of the experimental pots was 81.

Eighty one large plastic polyethylene pots (35 cm. diameter and 40 cm. depth) were used during two seasons. Each pot was filled with 10 kg air dried soil taken from the surface layer of the Experimental Farm of the Faculty of Agriculture.

Some properties of the experimental soil during both experiments are presented in Table 1.

Table 1. Some physical and chemical properties of the experimental soil samples in both seasons before cultivation.

Soil characters		2015 /2016	2016/2017
Mechanical analysis (%)	Coarse sand	4.16	4.55
	Fine sand	21.29	19.96
	Silt	31.52	30.53
	Clay	43.03	44.96
	Texture class	Clayey	Clayey
E.C. $dS.m^{-1}$(paste ext.)		4.19	4.11
pH (1:2.5)		7.95	7.79
SP %		62.5	63.1
OM %		1.69	1.72
Total $CaCO_3$ %		3.76	3.88
Available nutrients ($mg\ kg^{-1}$)	N	50.7	51.8
	P	4.83	5.23
	K	184.7	185.2

Cultivation of wheat grains :-Wheat grains cv Sakha 93 were obtained from the Agric. Res. Center Kafr El-Sheikh. On 25th and 20th November 2016 and 2017, respectively; 15 grains of wheat per pot were sown at equal distances. Three weeks later the plants were thinned to the most suitable ten ones per pot. Throughout the experiment, soil moisture was kept at 50% of water holding capacity by watering to the constant weight.

Organic fertilization:- Rice straw compost and chicken manure as a source of organic manures were used at the rate of 20 $m^3 fed^{-1}$. Each experimental pot was mixed with compost and chicken manure and irrigated up to saturation percentage. Then pots were left for two weeks to elucidate the damage on seedling and their roots resulted from the heat of decomposition and toxic effect of some formed compounds.

Some chemical properties of chicken manure and rice straw compost organic manures used are presented in Table 2.

Table 2. Average values of some chemical properties of organic manure sources:

Organic manure properties	Chicken manure		Rice straw compost	
	2015	2016	2015	2016
pH 1:5	6.23	6.19	5.98	6.10
EC (1:10)(dSm^{-1})	3.95	4.13	3.16	3.32
Organic matter (%)	69.49	71.97	39.62	40.18
Organic carbon (%)	40.31	41.75	22.9	23.8
Total nitrogen (%)	2.81	2.86	1.61	1.69
C/N ratio	15.05	14.59	14.22	14.08
Total Phosphorus (%)	0.47	0.41	0.38	0.33
Total Potassium (%)	0.98	1.04	0.82	0.76

Chemical fertilization:-The recommended doses (R.D) of mineral fertilizers used in this investigation were 75 kg ammonium sulphate (21% N), 100 kg calcium super phosphate (15.5% P_2O_5, 7% P) and 50 kg potassium sulphate (48% K_2O, 40% K) according to the Ministry of Agriculture, Egypt .

N fertilizer was added in 2 equal doses directly before the first and second irrigation, while the P fertilizer was added during soil preparation at the rates of (0, 50 and 100% from R.D) and K fertilizer was given in 2 equal doses after 20, 35 days from sowing at the rates of (0, 50 and 100% from R.D).

All plants were irrigated to reach the field capacity. Throughout the experiment and the assumed field capacity were compensated every3-4 days with tap water by weight.

At booting stage 60 days after sowing and at spiking stage (90 D.F.S) , five plants were randomly taken from each pot during both seasons. Plant samples were oven dried at 70°C tell constant weight was reached, then dry weight was recorded. The dried plant samples were thoroughly ground and stored for chemical analysis of N, P and K contents.

At harvesting stage (120 D.F.S), representative samples were randomly taken from each pot, separated into grains and straw. Then the parameters of yield components were determined as follow:

- No. of grains per spike.
- Spike length (cm.)
- Weight of 1000 grains (g)
- Grain yield ($g\ pot^{-1}$)
- Straw yield ($g\ pot^{-1}$)

Chemical analysis of plants: The oven dried straw and grains were ground and wet digested by a sulfuric-percloric acid mixture as described by Peterburgski (1968)

The total N, P and K were determined using the following methods:

- Total nitrogen (%) was determined using standard Kjeldahl method according to Hess (1971)
- Total phosphorus (%) was determined Spectrophotomitrically at wavelength 680 nm using stannous chloride reduced molybdosulphoric blue colour method in sulphoric system as desccribed by Jackson (1967).

- Potassium (%) was determined using a flame photometer according to Black (1965).
- Physical and chemical analyses of soil sample were determined as described by (Ryan *et al*., 1996).

Statistical analysis:- polled data using analysis of variance technique by means of CoSTATE Computer Software and compare the deference between the means of treatment values at the least significant difference (L.S.D) method.

RESULTS AND DISCUSSION

- **Yield and yield components of wheat plant:-**

Obtained results of this investigation which illustrated in Tables 3&4 indicate that the addition of organic manures significantly increased the average values of yield and its components of wheat plant at harvesting stage comparing with the control treatment during both seasons. Such effect may be attributed to the role played by organic manures for improving soil properties by providing a favorable soil structure, enhancing soil cation exchange capacity, increasing the quantity and availability of plant nutrients and providing the substrate of microbial activities.

In this respect, the addition of organic manures would have facilitated better aeration, adequate drainage and created a favorable soil environment for deeper penetration of roots and higher nutrient extraction from soil and subsequently healthy and optimum plant growth. These results are in accordance with the findings of Rashad *et al.*, (2011), Ahmad *et al*., (2013), Gobarah *et al.,* (2015) . Kany *et al.,* (2016) also revealed that application of organic manures produced the highest values of yield and its components (no. of grain spike^{-1}, spike length, weight of 1000 seeds, grain and straw yield) .These effects were connected with the treatment of rice straw compost and chicken manure as compared to the other source of organic manures.

Concerning the effect of phosphorus fertilization in rate of 50 and 100% on the mean values of yield and yield components of wheat plan compared with the control; data of Tables 3 & 4 showed significant increases in all parameters under study for the plants treated with both rates over that obtained from the untreated plants. In this respect; the highest values (58.69, 15.06, 93.54, 89.42 and 137.01) were realized for the treatment of 100% P-fertilization, while the lowest one (40.64, 10.49, 64.89, 62.01 and 95.01) were recorded for the untreated plants for No. of grains per spike, spike length cm and weight of 1000 grains (g) as well as grain and straw yield (g pot $^{-1}$), respectively.

These results could be enhanced with those obtained by Rahim *et al.,* (2010), Bereket *et al*., (2014), they all mentioned the effect of increasing P fertilization increased yield and its components, on the same line.

Arshad *et al*., (2016) conducted effect of phosphorus with three different levels of phosphorus (45, 90 and 135 kg ha^{-1}) on wheat crop. Applied phosphorus at the rate of 90 kg P_2O_5 ha^{-1} had significantly increased plant height (93.63cm), 1000 grains weight (46.80g), total dry matter (8113kg ha^{-1}), grain yield (4101.1 kg ha^{-1}) and straw yield (4012 kg ha^{-1}).

As shown in Tables 3 & 4 it could be noticed that the addition of potassium fertilization investigated was reflected on the mean values of yield and its components of wheat plants, which recorded the highest values for the plants treated with the rate of 100% P-fertilization, while the lowest one was realized for the untreated plants.

Table 3. Effects of organic manures, P&K fertilizations on grain and straw yield (g.pot $^{-1}$) during both seasons.

Treatments	Grain yield (g.pot $^{-1}$)		Straw yield (g.pot $^{-1}$)	
	1st	2nd	1st	2nd
Organic fertilization				
Control	75.83	78.78	116.20	120.63
Rice straw compost (20 m^{3}fed^{-1})	78.89	81.86	120.85	125.47
Chicken manure (20 m^{3}fed^{-1})	77.24	80.28	118.34	122.99
LSD at 5%	0.44	0.55	0.62	0.38
Phosphorus fertilization				
without fertilization	62.01	64.46	95.01	98.48
50% (3.5 kg P fed^{-1})	80.52	83.59	123.36	128.20
100% (7 kg P fed^{-1})	89.42	92.87	137.01	142.40
LSD at 5%	0.39	0.39	0.62	0.32
Potassium fertilization				
without fertilization	68.78	71.44	105.37	109.55
50% (10 kg K fed^{-1})	79.02	82.18	121.02	125.39
100% (20 kg K fed^{-1})	84.16	87.31	128.98	134.14
LSD at 5%	0.62	0.61	0.96	0.64

Table 4. Effects of organic manures, P&K fertilizations on No. of grains. spike^{-1}, spike length (cm) and weight of 1000 grains (g) during both seasons.

Treatments	No of grains. spike^{-1}		Spike length (cm)		Weight of 1000 grains (g)	
	1st	2nd	1st	2nd	1st	2nd
Organic fertilization						
Control	49.74	51.16	12.81	13.22	79.06	81.93
Rice straw compost (20 m^{3}fed^{-1})	51.75	53.23	13.31	13.74	82.51	85.56
Chicken manure (20 m^{3}fed^{-1})	50.66	52.47	13.04	13.41	80.80	83.68
LSD at 5%	0.25	0.49	0.08	0.19	0.01	0.17
Phosphorus fertilization						
without fertilization	40.64	41.80	10.49	10.71	64.89	67.15
50% (3.5 kg P fed^{-1})	52.82	54.42	13.61	14.12	83.95	87.00
100% (7 kg P fed^{-1})	58.69	60.63	15.06	15.54	93.54	97.02
LSD at 5%	0.25	0.46	0.06	0.14	0.02	0.15
Potassium fertilization						
without fertilization	45.12	46.54	11.61	11.95	71.70	74.29
50% (10 kg K fed^{-1})	51.82	53.37	13.34	13.80	82.47	85.52
100% (20 kg K fed^{-1})	55.21	56.94	14.21	14.62	88.21	91.36
LSD at 5%	0.41	0.43	0.11	0.13	0.02	0.13

The result revealed that K level had significant effect on yield and its components of wheat in 100% K might be due to the balanced accumulation of different nutrient elements in the grain resulting higher grain weight. This result is also in agreement with the findings of Mesbah (2009), Saha *et al.,* (2010), Awon *et al.* (2012), and Hamouda *et al.,* (2015) who indicated that application of potassium fertilization had significant increasing effects on yield and its components of wheat plant (No. ofspikes character and yield of straw, grain and biological yield as well as 1000-grain weight) as compared with un-treated plants.

The interaction effects between organic manures, phosphorus and potassium fertilization treatments are shown in Tables 5 & 6. Results revealed that the most suitable treatment which realized the highest values of yield and its components was connected with the plants treated with rice straw compost + 100% from P and K fertilization. Such effect for the same treatment was true during both seasons of the experiments.

Table 5. Interaction effect of organic manures and P&K fertilizations on grain and straw yield during both seasons.

Treatments			Grain yield (g.pot $^{-1}$)		Straw yield (g.pot $^{-1}$)	
Organic	**P-fertilization**	**K-fertilization**	**1st**	**2nd**	**1st**	**2nd**
Control	without	without	57.02	59.40	87.37	90.53
		50%	59.90	62.43	91.82	93.86
		100%	64.69	66.85	99.15	103.74
	50%	without	71.40	74.18	109.36	113.63
		50%	80.30	83.51	123.03	127.61
		100%	84.99	87.95	130.27	135.31
	100%	without	74.16	77.13	113.66	118.81
		50%	91.75	95.48	140.54	145.63
		100%	98.26	102.12	150.59	156.52
Rice straw Compost (20 $m^3 fed^{-1}$)	without	without	59.08	61.58	90.52	94.00
		50%	63.44	65.98	97.13	100.08
		100%	67.71	70.40	103.80	107.96
	50%	without	73.57	76.50	112.68	116.89
		50%	83.69	87.03	128.13	133.15
		100%	88.91	92.37	136.21	141.96
	100%	without	78.32	80.78	119.96	124.46
		50%	95.00	98.47	145.45	151.01
		100%	100.26	103.65	153.75	159.77
Chicken manure (20 $m^3 fed^{-1}$)	without	without	58.09	60.41	88.98	92.74
		50%	61.07	63.50	93.50	96.90
		100%	67.13	69.62	102.83	106.54
	50%	without	71.20	73.58	109.03	113.53
		50%	83.51	86.62	127.96	132.88
		100%	87.15	90.61	133.60	138.88
	100%	without	76.18	79.36	116.82	121.40
		50%	92.50	96.60	141.65	147.42
		100%	98.33	102.26	150.66	156.59
$LSD_{at\ 5\%}$			1.88	1.83	2.88	1.93

***50% R.D of phosphorus fertilization:- (3.5 kg P fed^{-1})** ***100% R.D of phosphorus fertilization:- (7 kg P fed^{-1})**
***50% R.D of potassium fertilization:- (10 kg K fed^{-1})** ***100% R.D of potassium fertilization:- (20 kg K fed^{-1})**

Table 6. Interaction effects of organic manures, P&K mineral fertilizations on No. of grains. spike^{-1}, spike length (cm) and weight of 1000 grains (g) during both seasons..

Treatments			No of grains spike^{-1}		Spike length (cm)		Weight of 1000 grains (g)	
Organic	**P-fertilization**	**K-fertilization**	**1st**	**2nd**	**1st**	**2nd**	**1st**	**2nd**
Control	without	without	37.40	38.21	9.64	9.69	58.63	60.21
		50%	39.27	40.18	10.11	10.02	62.96	65.12
		100%	42.41	43.76	10.92	11.29	68.63	71.17
	50%	without	46.79	48.00	12.14	12.63	73.62	76.31
		50%	52.69	54.16	13.63	14.07	83.95	87.07
		100%	55.88	57.47	14.35	15.04	88.95	92.07
	100%	without	48.77	50.60	12.47	13.02	77.96	81.08
		50%	60.14	61.88	15.44	16.08	94.94	98.31
		100%	64.32	66.14	16.57	17.13	101.94	106.02
Rice straw Compost (20 $m^3 fed^{-1}$)	without	without	38.72	39.54	9.95	10.21	60.96	63.17
		50%	41.51	42.17	10.71	11.17	66.30	68.95
		100%	44.43	45.30	11.50	11.95	71.96	74.14
	50%	without	48.26	49.52	12.43	12.96	76.62	79.16
		50%	54.88	56.41	14.24	14.91	87.62	91.02
		100%	58.32	60.65	14.93	15.34	92.61	96.15
	100%	without	51.42	53.12	13.14	13.27	81.95	85.23
		50%	62.37	64.53	15.94	16.76	98.94	102.91
		100%	65.81	67.78	16.96	17.14	105.60	109.36
Chicken manure (20 $m^3 fed^{-1}$)	without	without	38.08	39.77	9.79	10.11	59.96	62.16
		50%	39.98	41.58	10.34	10.75	64.63	67.11
		100%	43.95	45.70	11.42	11.24	69.96	72.29
	50%	without	46.65	47.87	12.10	12.52	75.29	78.16
		50%	54.73	56.25	14.08	14.38	86.28	89.04
		100%	57.21	59.49	14.64	15.19	90.61	94.00
	100%	without	50.00	52.26	12.80	13.18	80.28	83.13
		50%	60.77	63.20	15.56	16.02	96.61	100.14
		100%	64.60	66.16	16.62	17.28	103.60	107.05
$LSD_{at\ 5\%}$			1.24	1.30	0.33	0.40	0.02	0.38

***50% R.D of phosphorus fertilization:- (3.5 kg P fed^{-1})** ***100% R.D of phosphorus fertilization:- (7 kg P fed^{-1})**
***50% R.D of potassium fertilization:- (10 kg K fed^{-1})** ***100% R.D of potassium fertilization:- (20 kg K fed^{-1})**

N, P and K concentrations (%) during all growth stages of wheat plant :

The different comparison between the mean values of N, P and K (%) during all growth stages as affected by the combination between organic manures and P &K fertilizations under investigation are presented in Table 7, 8 & 9 ; respectively.

Data clearly show that 100% from potassium and phosphorus recommended fertilization in combination with organic manure has been recorded a stimulation effect on

the average values of all the aforementioned traits during all growth stages. In addition, the highest mean values of N concentration (2.82 , 3.15 1.11 and 3.21) were recorded for the treatment of compost rice straw+ 100% P + 100% K, while the lowest one were connected with the treatment of control without any addition in the 1st season and the same trend in the 2nd season after 60 and 90 days of cultivation and harvesting stage (straw and grain yield) ; respectively as shown in Table 7.

Table 7. Interaction effects of organic manures and P&K fertilizations on N concentration (%) during all growth stages in both seasons.

Treatments			60 Days		90 Days		120 Days (straw)		120 Days (grains)	
Organic	P-fertilization	K-fertilization	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	without	without	1.59	1.69	1.79	1.94	0.58	0.60	1.69	1.88
		50%	1.64	1.71	1.88	1.99	0.62	0.64	1.81	1.99
		100%	1.77	1.88	2.03	2.15	0.69	0.72	2.00	2.17
	50%	without	1.86	2.01	2.24	2.37	0.75	0.78	2.13	2.35
		50%	2.13	2.25	2.52	2.66	0.87	0.91	2.52	2.60
		100%	2.29	2.42	2.67	2.77	0.96	1.00	2.68	2.89
	100%	without	2.01	2.09	2.33	2.42	0.80	0.83	2.32	2.41
		50%	2.41	2.52	2.88	3.04	1.02	1.06	2.80	3.05
		100%	2.63	2.75	3.08	3.23	1.08	1.12	3.09	3.18
rice straw Compost (20 $m^3 fed^{-1}$)	without	without	1.62	1.68	1.85	1.97	0.60	0.62	1.76	1.95
		50%	1.72	1.82	1.99	2.13	0.66	0.69	1.96	2.12
		100%	1.84	1.95	2.13	2.24	0.74	0.77	2.11	2.23
	50%	without	1.99	2.08	2.31	2.43	0.79	0.82	2.26	2.41
		50%	2.21	2.30	2.63	2.75	0.93	0.97	2.59	2.85
		100%	2.34	2.46	2.79	3.00	0.99	1.03	2.81	2.91
	100%	without	2.11	2.20	2.46	2.61	0.83	0.86	2.48	2.65
		50%	2.57	2.69	2.98	3.14	1.06	1.10	2.92	3.21
		100%	2.82	2.95	3.15	3.33	1.11	1.16	3.21	3.44
Chicken manure (20 $m^3 fed^{-1}$)	without	without	1.59	1.65	1.82	1.93	0.59	0.61	1.72	1.92
		50%	1.67	1.74	1.92	2.09	0.63	0.66	1.87	1.90
		100%	1.80	1.89	2.11	2.24	0.73	0.76	2.08	2.30
	50%	without	1.91	2.01	2.23	2.35	0.78	0.81	2.21	2.24
		50%	2.19	2.29	2.62	2.78	0.90	0.94	2.58	2.82
		100%	2.35	2.46	2.74	2.97	0.98	1.02	2.71	2.82
	100%	without	2.04	2.12	2.39	2.54	0.84	0.87	2.35	2.37
		50%	2.49	2.60	2.90	3.07	1.03	1.07	2.88	3.01
		100%	2.73	2.88	3.09	3.25	1.10	1.15	3.14	3.23
$LSD_{at\ 5\%}$			0.05	0.05	0.06	0.07	0.05	0.05	0.05	0.06

***50% R.D of phosphorus fertilization:- (3.5 kg P fed^{-1})** ***100% R.D of phosphorus fertilization:- (7 kg P fed^{-1})**
***50% R.D of potassium fertilization:- (10 kg K fed^{-1})** ***100% R.D of potassium fertilization:- (20 kg K fed^{-1})**

At Table 8 found that the average values of phosphorus as affected by the combination between the various treatments under investigation. It could be observed that; a positive effect was happened on the mean values of all phosphorus concentrations under study due to using the combination between the studied parameters. In this respect, the highest values; (0.299, 0.331, 0.117 and 0.309) for P in wheat plant throughout all growth stages; respectively; in the 1st season was obtained for the treatment of compost rice straw+ 100% P + 100% K fertilization and all these values were better than that obtained for the control treatment. The same trend was true in the 2nd season.

The interaction effect between the treatments under study was also reflected on the mean values of the nutritional element of wheat plant as shown in Table 9. These values show a positive effect on K % along the stages from germination stage after 60 days till harvesting stage after 120 days represented in straw and grain yield as compared to the control treatment. The increases percentage over the control treatment for the values of K % were (2.57, 2.98 , 1.08 and 1.65) in the 1st season, respectively for the best suitable treatment of compost rice straw+ 100% P + 100% K fertilization.

These results could be referd to the role of organic manures in soil properties which produce humus substances wherein amended the chemical and physical soil properties leading to increament nutrients release availability, i.e., N, P and K uptake. Moreover, incorporation of organic materials in soils can further increase NPK availability by increasing CO_2 forming H_2CO_3 in the soil solution. In the same line, application of organic amendments such as rice straw compost and chicken manure increased the inorganic N, P & K fractions. These increases were reported by Rashad *et al.*, (2011) and Kany (2016) who found that adding organic manure sources (chicken manure, FYM, rice straw compost and town refuse compost) affects in average values of N, P and K% in straw and grain were realized the great values with using rice straw compost.

Obtained results are also enhanced with those reported by Laghari *et al*., (2010) and Youssef *et al.,* (2013) who studied different levels of phosphorus (0 and 53 kg P_2O_5 ha^{-1}) on uptake of N, P and K by wheat grain. The uptake of N, P, K and protein content in wheat grains was increased with increasing 53 kg P_2O_5 ha^{-1}.

Previous results also confirmed the effects of potassium on nutrient status of wheat plant and found that potassium had significant increasing on nutrient concentrations (N, P, K) of wheat leaves, straw and grains such as Gaj and Górski (2014) and Hamouda *et al.,* (2015).

Table 8. Interaction effects of organic manures and P&K fertilizations on P concentration (%) during all growth stages in both seasons.

Treatments			60 Days		90 Days		120 Days (straw)		120 Days(grains)	
Organic	P-fertilization	K-fertilization	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	without	without	0.161	0.174	0.188	0.192	0.062	0.063	0.118	0.130
		50%	0.178	0.184	0.203	0.207	0.068	0.072	0.131	0.145
		100%	0.185	0.197	0.215	0.222	0.075	0.075	0.150	0.163
	50%	without	0.201	0.211	0.231	0.236	0.082	0.083	0.174	0.186
		50%	0.231	0.242	0.264	0.268	0.092	0.095	0.211	0.234
		100%	0.237	0.250	0.276	0.283	0.102	0.106	0.230	0.248
	100%	without	0.208	0.216	0.249	0.254	0.086	0.088	0.187	0.198
		50%	0.253	0.260	0.300	0.306	0.110	0.115	0.262	0.285
		100%	0.276	0.286	0.316	0.324	0.115	0.121	0.290	0.319
rice straw Compost ($20\ m^3 fed^{-1}$)	without	without	0.169	0.174	0.194	0.203	0.063	0.066	0.125	0.136
		50%	0.184	0.186	0.214	0.225	0.075	0.071	0.143	0.155
		100%	0.193	0.204	0.228	0.235	0.079	0.084	0.165	0.179
	50%	without	0.209	0.218	0.243	0.247	0.082	0.086	0.184	0.192
		50%	0.231	0.241	0.273	0.280	0.099	0.106	0.222	0.246
		100%	0.247	0.252	0.294	0.274	0.104	0.112	0.253	0.270
	100%	0%	0.224	0.231	0.254	0.260	0.092	0.096	0.204	0.219
		50%	0.266	0.274	0.314	0.315	0.113	0.119	0.280	0.310
		100%	0.299	0.313	0.331	0.341	0.117	0.121	0.309	0.337
Chicken manure ($20\ m^3 fed^{-1}$)	without	without	0.164	0.164	0.193	0.197	0.065	0.067	0.122	0.130
		50%	0.178	0.185	0.208	0.214	0.070	0.075	0.142	0.150
		100%	0.191	0.197	0.221	0.226	0.074	0.076	0.156	0.175
	50%	without	0.205	0.212	0.235	0.231	0.082	0.088	0.180	0.193
		50%	0.228	0.238	0.270	0.276	0.095	0.101	0.215	0.234
		100%	0.241	0.249	0.285	0.298	0.103	0.107	0.244	0.262
	100%	without	0.213	0.219	0.253	0.263	0.086	0.091	0.196	0.207
		50%	0.261	0.271	0.304	0.310	0.112	0.117	0.265	0.281
		100%	0.287	0.298	0.328	0.332	0.118	0.125	0.300	0.315
$LSD_{at\ 5\%}$			0.006	0.007	0.007	0.017	0.005	0.007	0.005	0.007

***50% R.D of phosphorus fertilization:- (3.5 kg P fed^{-1})** ***100% R.D of phosphorus fertilization:- (7 kg P fed^{-1})**
***50% R.D of potassium fertilization:- (10 kg K fed^{-1})** ***100% R.D of potassium fertilization:- (20 kg K fed^{-1})**

Table 9. Interaction effects of organic manures and P&K fertilizations on K concentration (%) during all growth stages in both seasons.

Treatments			60 Days		90 Days		120 Days (straw)		120 Days(grains)	
Organic	P-fertilization	K-fertilization	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	without	without	1.16	1.21	1.38	1.44	0.49	0.61	0.66	0.74
		50%	1.62	1.64	1.87	1.94	0.65	0.79	0.95	1.15
		100%	2.13	2.12	2.40	2.50	0.87	0.98	1.37	1.51
	50%	without	1.28	1.29	1.57	1.63	0.54	0.64	0.76	0.88
		50%	1.91	1.98	2.17	2.26	0.78	0.92	1.22	1.35
		100%	2.31	2.38	2.65	2.76	0.99	1.07	1.53	1.65
	100%	without	1.43	1.43	1.72	1.79	0.61	0.74	0.84	0.99
		50%	1.73	1.71	2.00	2.08	0.71	0.82	1.10	1.25
		100%	2.29	2.32	2.59	2.69	0.97	1.07	1.49	1.73
rice straw Compost ($20\ m^3 fed^{-1}$)	without	without	1.25	1.26	1.51	1.57	0.52	0.61	0.72	0.89
		50%	1.70	1.74	2.00	2.08	0.70	0.79	1.06	1.21
		100%	2.21	2.27	2.52	2.62	0.93	0.98	1.43	1.51
	50%	without	1.44	1.48	1.66	1.73	0.63	0.71	0.83	0.89
		50%	2.03	2.05	2.33	2.42	0.88	0.98	1.27	1.38
		100%	2.61	2.64	3.15	3.28	1.16	1.28	1.71	1.86
	100%	without	1.58	1.61	1.79	1.86	0.63	0.71	0.94	0.99
		50%	1.87	1.92	2.15	2.24	0.80	0.87	1.22	1.34
		100%	2.57	2.61	2.98	3.10	1.08	1.24	1.65	1.80
Chicken manure ($20\ m^3 fed^{-1}$)	without	without	1.21	1.25	1.47	1.53	0.51	0.62	0.66	0.75
		50%	1.64	1.65	1.92	2.00	0.69	0.73	1.03	1.10
		100%	2.15	2.17	2.47	2.57	0.91	1.07	1.39	1.55
	50%	without	1.34	1.37	1.61	1.68	0.57	0.64	0.83	0.83
		50%	1.94	1.98	2.22	2.31	0.84	0.94	1.25	1.41
		100%	2.45	2.47	2.84	2.95	1.07	1.13	1.57	1.63
	100%	without	1.51	1.51	1.74	1.81	0.63	0.74	0.89	0.97
		50%	1.84	1.82	2.09	2.17	0.73	0.79	1.17	1.21
		100%	2.40	2.42	2.75	2.86	1.05	1.16	1.55	1.64
$LSD_{at\ 5\%}$			0.07	0.05	0.07	0.07	0.06	0.07	0.05	0.05

***50% R.D of phosphorus fertilization:- (3.5 kg P fed^{-1})** ***100% R.D of phosphorus fertilization:- (7 kg P fed^{-1})**
***50% R.D of potassium fertilization:- (10 kg K fed^{-1})** ***100% R.D of potassium fertilization:- (20 kg K fed^{-1})**

CONCLUSION

It could be concluded that the use of 20 m^3 fed^{-1} of rice straw compost as organic manure fertilizer with applying 100 % of phosphorus fertilizer + 100% of potassium fertilizer could enhance the yield and its component and nutrient contents of wheat plants .

REFERENCES

Agri-News (2012). E-Newsletter: Wheat nutrition and fertilizer requirements: potassium. Available from agric. gov.ab.ca/$Department/deptdocs.nsf/All/ webdoc7998. [November 4, 2015]

Ahmad, M.; M. Afzal, A. Ahmad, A. U. H. Ahmad and M. I. Azeem (2013). Role of organic and inorganic nutrient sources in improving wheat crop production. Cercetări Agronomice în Moldova, XLVI, 1 (153): 15-21.

Arshad, M.; M. Adnan, S. Ahmed, A. K. Khan, I. Ali, M. Ali, A. Ali, A. Khan, M. A. Kamal, F. Gul and M. A. Khan (2016). Integrated effect of phosphorus and zinc on wheat crop. American-Eurasian J. Agric. and Environ. Sci., 16 (3): 455-459.

Awon, M.; S. Raza, M. F. Saleem, S. A. Anjum, T. Khaliq and M. A. Wahid (2012). Foliar application of potassium under water deficit conditions improved the growth and yield of wheat (*Triticum aestivum* L.). Journal of Animal and Plant Science 22: 431-437.

Bereket, H.; H. Dawit, H. Mehretab and G. Gebremedhin (2014). Effects of mineral nitrogen and phosphorus fertilizers on yield and nutrient utilization of bread wheat (*Tritcum aestivum*) on the sandy soils of Hawzen District, Northern Ethiopia, Agriculture, Forestry and Fisheries 3(3): 189-198.

Black, C. A. (1965). "Methods of Soil Analysis." Part 1 and 2, Madison, Wiscansin, USA.

Dhaliwal, S. S., M. K. Walia and R. P. Phutela (2012). Effect of inorganic fertilizers and manures application on macro and micronutrients distribution under long term rice-wheat system. J. Pl. Sci. Res., 28 (1) 149-161.

EL - Beyali, U.S.; A. I. EL-Shafi and A. H. Ahmed (2001). Efficiency of soil and foliar application of potassium fertilizer on yield, yield components and some nutritional constituents of wheat grain on alluvial Bahtim soil. Egypt J. Applied Sci. 16: 297-313.

El-Etr, Wafaa T.; Laila, K. M. , E. I. Ali and El ham I. El-khatib (2004). Comparative effects of bio-compost and compost on growth, yield and nutrients content of pea and wheat plants grown on sandy soils. Egypt. J. Agric. Res., 82 (2): 73-94.

Gaj, R. and D. Górski (2014). Effects of different phosphorus and potassium fertilization on contents and uptake of macronutrients (N, P, K, Ca, Mg) in winter wheat I. Content of macronutrients. J. Central European Agric.,, 15(4):169-187.

Gomez, K. A., and A. A. Gomez, (1984). "Statistical Procedures for Agricultural Research". John Wiley and Sons, Inc., New York.pp:680.

Hamouda, H. A.; M. F. El-Dahshouri, F. M. Manal and A. T. Thalooth (2015). Growth, yield and nutrient status of wheat plants as affected by potassium and iron foliar application in sandy soil. Int. J. Chem. Tech. Res., 8 (4): 1473-1481. (22)

Hesse, P.R.(1971). A Text book of Soil Chemical Analysis. John Murray Ltd , London. Pp.520.

Jackson, M. L. (1967). "Soil Chemical Analysis." Printic Hall of India New Delhi.

Kany, M. A. (2016). Evaluation of some organic manures. Thesis Ph.D. Fac. Agric. Mans. Univ. Egypt.

Kaur, K.; K. K. Kapoor and A. P. Gupta (2005). Impact of organic manures with and without mineral fertilizers on soil chemical and biological properties under tropical conditions. J. Plant Nutrition and Soil Sci., 168: 117-122.

Laghari, G. M.; F. C. Oad, S. Tunio, A. W. Gandahi, M. H. Siddiqui, A. W. Jagirani and S. M. Oad (2010). Growth, yield and nutrient uptake of various wheat cultivars under different fertilizer regimes. Sarhad J. Agric, 26 (4):489-497.

Mesbah, E.A. E. (2009). Effect of irrigation regimes and foliar spraying of potassium on yield, yield component and water use efficiency of wheat (*Triticumaestivum L.*) in sandy soils. World J.of Agril. Sci., 5(6): 662-669.

Peterburgski, A. V. (1968). "Hand Book of Agronomic Chemistry". Kolas Publishing House Moscow, (in Russian).

Pettigrew, W. T. (2008). Potassium influences on yield and quality production for maize, wheat, soybean and cotton. Physiologia Plantarum. 133, 670-681.

Rahim, A.; A. M. Ranjah, Rahamtullah and E. A. Waraich (2010). Effect of phosphorus application and irrigation scheduling on wheat yield and phosphorus use efficiency. Soil Sci. Soc. Pak., 29: 15-22.

Rashad, F. M.; H. H. Kesba, W. D. Saleh and M. A. Moselhy (2011). Impact of rice straw composts on microbial population, plant growth, nutrient uptake and root-knot nematode under greenhouse conditions. African J. Agric. Res., 6 (5): 1188-1203.

Ryan, J. , S. Garabet , K. Harmsen and A. Rashid (1996). A soil and Plant Manual Adapted for the West Asia and Africa Region ICARDA , Aleppo , Syria .140pp.

Saha, P. K.; A. T. M. S. Hossain and M. A. M. Miah (2010). Effect of potassium application on wheat (*Triticum aestivum* L.) in old himalayan piedmont plain. Bangladesh J. Agril. Res. 35(2) : 207-216. (29)

Saqib, B.; Shazma, A.; Bashir,A. ; Qamar, S.; Wajid, K. and Muhamad, I . (2015) . Response of Wheat Crop to Phosphorus Levels and Application Methods . Journal of Environment and Earth Science , 5(9) : 151-155.

Sobh, M .M.; M. S. Sharshar and S. A. Al-Said (2000). Response of wheat to nitrogen and potassium application in a salt affected soil J. Product Dev., 5(1) :83- 98.

SQO (Soil Quality Organization) (2015). Fact Sheets Potassium. Available from: http://www.soilquality. org.au/factsheets/potassium. [November 4, 2015].

Youssef, S. M. ; S. E.-D. Faizy, S. A. Mashali, H. R. El-Ramady and Sh. Ragab (2013). Effect of different levels of NPK on wheat crop in North Delta. Jahrestagung der Deutschen Bodenkundlichen Gesellschaft vom 07. Bis 12. September 2013 in Rostock; Vorträge Kommission IV, Berichte der DBG (nicht begutachtete online-Publikation). www. dbges. de.

تأثير التفاعل بين الأسمدة العضوية والفوسفاتية والبوتاسية على المحصول ومحتوى العناصر لنبات القمح

خالد حسن الحامدى ، محمود موسي عمر و منى أحمد الجندى

كلية الزراعة ـ قسم الأراضى- جامعة المنصورة ـ مصر

اجريت تجربة أصص فى التربة الطينية بمزرعة كلية الزراعة -جامعة المنصورة– مصر خلال الموسمين الشتويين ٢٠١٥/٢٠١٦ و ٢٠١٦/٢٠١٧ لدراسة تاثير إضافة السماد العضوى و الفوسفاتى والبوتاسي و التفاعل بينهم على صفات المحصول ومكوناته لنبات القمح وكذلك محتوى العناصر به. اشتملت التجربة على ٢٧ معاملة فى تصميم منشق مرتين فى ثلاث مكررات تمثل التفاعلات الممكنة بين: ثلاث معاملات كمصدر للتسميد العضوى (كنترول، كمبوست قش الأرز، سماد الدواجن كمعاملات رئيسيه) و ثلاث معدلات من التسميد الفوسفاتى (٠، ٥٠، ١٠٠% من الموصى به كمعامله تحت رئيسيه) و ثلاث معدلات من التسميد البوتاسي (٠، ٥٠ ، ١٠٠% من الموصى به كمعاملات منشقة) وبذلك يكون العدد الكلى للأصص ٨١ اصيص لكل موسم. اظهرت النتائج ان استخدام كمبوست قش الأرز وسماد الدواجن أدى لحدوث زيادة معنوية فى عدد الحبوب، سمك السنبلة ، وزن ١٠٠٠ حبة وأيضاً محصول الحبوب ومحصول القش وسجلت أعلى النتائج عند استخدام كمبوست قش الارز.كما أن إضافة السماد الفوسفاتى أدى لزيادة معنوية للصفات تحت الدراسة وسجلت أعلى القيم عند استخدام معدل ١٠٠% من الموصى به مقارنة بالنباتات الغير معاملة وجد ان استخدام السماد البوتاسي لنبات القمح أعطى أعلى القيم للصفات السابقة مقارنة بالكنترول وسجلت أعلى القيم عند اسنخدام ١٠٠% من التسميد البوتاسى الموصى به. أما بالنسبة للتفاعل المشترك بين المعاملات وجد أن أفضل إضافة للحصول على أعلى القيم للصفات كانت عند استخدام كبوست قش الأرز+١٠٠% من الموصى به لكل من التسميد الفوسفاتى والبوتاسى خلال كلا الموسمين.اتضح أيضاً من التفاعل بين التسميد العضوى والتسميد المعدنى بإضافة السماد الفوسفاتى والبوتاسي وجود زيادة معنوية فى نسب العناصر وكانت أعلى قيمة لعناصر النتروجين والفوسفور والبوتاسيوم عند التسميد العضوى بالكمبوست مع إضافة ١٠٠% من الموصى به من سماد سوبر فوسفات الكالسيوم مع ١٠٠% من سماد كبريتات البوتاسيوم، وذلك على مدار مراحل النمو المختلفة مروراً بمرحلة الانبات ومرحلة طرد السنابل حتى مرحلة الحصاد المتمثلة فى كلٍ من محصول القش والحبوب .