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Effect of Biochar, Compost, Chicken Manure and Mineral Fertilization on Wheat and Barley Plants Grown on Sandy Soil

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ABSTRACT

Two field experiments in spit plot design were carried out in winter season of 2014-2015 at Mansoura University Farm, Qalabshu region, Dakhlia Governorate, Egypt, to investigate Wheat and barley productivity as affected by biochar, compost, chicken manure with different rates of mineral fertilization. The obtained results can be summarized in ; biochar, compost and chicken manure addition led to increase wheat grain yield by 6.36, 14.92 and 21.21 % compared with 0.0 organic addition, where the same amendment with the same order increased barley grain yield by 16.59, 28.43 and 31.17 %. Mineral fertilizer increased both wheat and Barely grain yield up to the highest level used, 125 % of recommended NPK. Chicken manure treatment recorded the highest straw yield, 4002.5 and 2511.3 Kg fed.$^{-1}$, of wheat and barley, respectively, So recorded the highest values of 1000-grain weight of wheat, 50.53, and barley, 43.90 gm., respectively. A significant organic fertilizer types - mineral fertilization dose interaction was found regarding to 1000 grain weight of wheat where a non-significant interaction was found regarding to 1000 grain weight of barley. Chicken manure - 125% of recommended NPK treatment gives the heights values of wheat and barley grains N content, 1.81 and 1.699 %. Biochar, compost and Chicken manure increased P content of wheat grains by 18.0, 29.0 and 34.0 % Compared with 0.0 organic matter. A similar trend was also achieved with barley , where The percentage of increase were 34.9 , 34.9 and 49.0%, respectively. Increasing mineral fertilization level from 100 % to 125 % increased p content of wheat and barley by 4.0 and 3.0 %, respectively. Very little increase but significant was found in K content of wheat and barley due to appling biochar treatment, 5040.0 Kg fed.$^{-1}$, compared to 0.0 organic treatment. The highest value of K content for wheat, 0.284 and barley, 0.506 %, were achieved with 125% of NPK recommendation dose treatment.

Keywords : Biochar; compost; chicken manure; mineral fertilization; wheat ; barley ; sandy soil

INTRODUCTION

Wheat is the most important cereal crop as the main food stable for the Egyptian public. Improving the productivity of this crop is a main task due to its short supply which mandated importing about 50% of the needed wheat grains from outside the country (FAO 2009). Barley can compensate wheat shortage as the staple food.

Growing wheat and barley on newly reclaimed area of Egypt which has poor physical properties and lacks of organic matter, macro and micro - nutrients is the main way to stop wheat importing.

Usage of organic material continuously is a favorable way of improving soil physical and chemical properties, where, soil humus content increase. (Sarwar et al, 2008). Farmyard –manure, compost and chicken manure known as organic amendment, Nowadays, biochar is classified as a new soil organic matter amendment (Deenik et al., 2011).

The main objective of this study was to assess the effect of biochar as organic material compared to compost and chicken manure) on wheat and barley production.

MATERIALS AND METHODS

Two field experiments were carried out in winter season of 2014-2015 at Mansoura University Farm, Qalabshu region, Dakhlia Governorate, Egypt, to investigate wheat (Sakha 68) and barley (Gemeza 123) productivity and its nutrients content under different application rates of mineral and organic fertilizers .

Sandy soil, 70 % sand, 11% silt and 19% clay. Clay was artificially added within a clayey soil which incorporated with the surface layer, 30 cm, 15 years ago. The mixed surface layer have electrical conductivity of 1.86 dSm^{-1}, a pH value of 8.5 and the available N, P and K were 17.0, 2.5 and 62.0 ppm , respectively .

Irrigation water, all qalabshu region mainly depends on drainage water in irrigation process, where its dissolved salts content is less than 2000 ppm in winter season, 2.45 dSm^{-1}, was measured in a growing season period .

Soil was vertically harrowed twice, land leveling and divided as split plot design. Four organic fertilizer treatments (0.0 organic, biochar ,0.5 % of 15 cm surface layer weight (5040.0 kg fed.$^{-1}$), compost, 10000 kg/fed, and Chicken manure, 5000 kg fed.$^{-1}$) occupied main plot while sub plot was occupied with four levels (50 %, 75 %, 100% and 125 % of recommended N,P,K) of mineral fertilization, hence the experiment comprise from 16 plots with four replicate to be 64 experimental plot. Each plot have a 2.5 m width *10m length.

Appropriate organic fertilizer was added to the surface of appropriate plots 15 day before planting (15/11/2014) and mixed well by a small rotary plow, then irrigation was done. One week later soil was plowed with a small rotary plow. Sown was done by soaked seeds (one hour for wheat and three hour for barely) were left for two hours after soaking to ease seed distribution as equal, at a rate 60.0 and 45.0 kg fed.$^{-1}$ for wheat and barley, respectively .

The used biochar represent the finest byproduct of charcoal manufacture with an EC value of 6.48 (dSm^{-1} in paste extract), pH of 12.5 (in paste) and available NPK as 2.36, 13.90, 268.00 ppm, respectively. It was brought from kom-ombo, abo-Elmatameer district,

Elbehara province, Egypt. Compost was manufacture by organic farming project, Faculty of Agriculture, Mansoura Univ. Egypt, 2011/2015. This compost have an EC of 2.15 dSm^{-1} (in paste extract)**,** pH of 6.8 (in paste) and available NPK as 56.6, 19.6, 100.6 ppm, respectively. Chicken manure with an EC of 5.16 dSm^{-1} (in paste extract)**,** pH of 7.5 (in paste) and available NPK 60.09, 24.21, 225.20 ppm, respectively, was collected from poultry farm of Qalabshu Research Center, Faculty of Agriculture , Mansoura Univ., Egypt.

The ministry of agriculture recommendation is 70 Kg N fed^{-1} , 31.0 Kg P_2O_5 fed^{-1} and 50 Kg K_2O fed^{-1}. Urea (46 % N), calcium super-phosphate (15.5 % P_2O_5) and potassium sulphate (48 % K_2O) were used as a source of N, P and K, respectively. All P fertilizer was added to appropriate plot at sowing date .Each of N and K fertilizer was divided into two equal doses, one was added 20 days later from sowing and the other at the end of elongation stage, two weeks before spike appearance stage.

Each crop was harvested at its fully mature stage where all plant become yellowish in colour and the spikes were bent down . Barley was harvested by the end of March and wheat by the end of April. All plants of one square meter from each plot were collected , weighed immediately in the field and representative samples were transferred to the lab. where air dried, oven dried at 70 ^{o}C till constant weight were done. The weight of one thousands of grains was determined for each treatment. Husk and straw dry weight was calculated.

Soil analysis:

The electrical conductivities of the soil paste extracts were measured by EC meter according to Black, (1965). Soil reaction (pH) was measured in soil paste by using Beckman pH meter (Black, 1965). Mechanical analysis was determined as described by Piper,(1950). Available N was extracted by potassium chloride 1 N and measured using the conventional method of Kjeldahl as described by Bremner and Mulvany, (1982).

Available P was extracted with 0.5 M ($NaHCO_3$) adjusted at pH 8.5 and determined at a wavelength 660 nm by spectrophotometer as described by Olsen and Sommers, (1982). Available K was extracted by ammonium acetate 1 N , pH 7.00 and determined by using Flam photometer according to Black, (1965). Chemical analyses of biochar, compost and chicken manure were determined according to the standard methods described by the Association of Official Analytic Chemists (A.O.A.C.,1990).

Plant analysis:

Samples of oven dry grain and straw were grained in stainless milder. 0.2 gm plant sample powder was digested in a mixture of $HClO_4$ and H_2SO_4 according to the procedure of Chapman and Pratt, (1961) to determine the percentage of NPK.

Total nitrogen was determined by microKjeldahl method as described by Hesse, (1971). Total phosphorus was determined calorimetrically at a wavelength of 660 nm using (Olsen, and Sommers, 1982). Total potassium was determined using flame photometer according to Jackson, (1967).

Statistical analysis:

All data were Statistically analysis According to Gomez and Gomez using CO-STAT-C computer software package. The least significant difference at (0.05) level of probability was used for testing the means of the different variables.

RESULTS AND DISCUSSION

Data plotted in Table (1)shows the organic fertilizer types and mineral fertilization doses effect on wheat and barley grain yield where it were significantly affected by each of studied factor or levels .

Regarding to organic fertilizer types effect on grain yields of wheat and barley plant data presented in Table 1 reveal that addition of any type resulted in an increase of grain yield of both wheat and barley compared with no addition. Biochar, compost and chicken manure addition increased wheat grain yield by 6.36, 14.92 and 21.21 % compared with 0.0 organic addition, where the same amendment with the same order increased barley grain yield by 16.59, 28.43 and 31.17 % compared with 0.0 organic addition. Hence the ability of tested organic material to increase grain yield was higher in barley than that of wheat. Chicken manure treatment recorded the highest grain yield, 2755.4 and 2555.9 Kg $fed.^{-1}$, of wheat and barley, respectively.

Table 1. Effect of organic and mineral fertilization on wheat and barley grain, straw yield and 1000 grain weight.

Characteristics	grain yield Kg $fed.^{-1}$		Straw yield Kg $fed.^{-1}$		1000 grain weight	
Treatments	**Wheat**	**Barely**	**Wheat**	**Barely**	**Wheat**	**Barely**
organic fertilizer treatments						
Control	2272.6	1990.1	3228.8	1775.4	47.073	41.216
Boichar	2417.1	2320.4	3268.1	2156.3	48.061	42.421
Compost	2609.4	2555.9	3774.9	2284.1	49.279	42.988
Chicken manure	2755.4	2611.1	4002.5	2511.3	50.538	43.901
LSD at 5%	152.9	134.7	234.8	333.9	0.52	0.69
F.test	**	**	**	**	**	**
mineral fertilizer treatments						
50%	2241.4	2039.8	3110.2	1832.5	47.138	41.977
75%	2495.8	2234.9	3553.0	2008.3	48.203	42.584
100%	2612.9	2533.1	3775.6	2556.9	49.126	42.786
125%	2704.3	2669.7	3835.5	2329.4	50.483	43.178
LSD at 5%	121.6	123.9	314.5	123.9	0.32	0.49
F.test	**	**	**	**	**	**

Organic matter ability to increase grain yield comes from its ability to provide plants with macro and micro nutrient, the previous results are in agreement with that of Chan *et al* (2008). They found a Significant additional wheat grain yield due to biochar addition .The yield increases were attributed to the ability of biochar to increase N availability largely, so, the non-activated poultry litter biochar produced higher available P content. So Alburquerque *et al.*, (2012) found a significant increase in wheat grain yield, 42 %, due to biochar applied at a rate or f 2.5 % w/w in the absence of mineral fertilization .

Data also declare that mineral fertilizer increased both wheat and Barely grain yield up to the highest level used, 125 % of recommended NPK. The highest increase in grain yield of wheat and barley were 20.65 and 30.88 % of that obtained with 50 % of recommended NPK. The difference in wheat grain yield between 100 and 125 % of recommended NPK treatment means is not significant, while the difference between the same treatment means in grain barley is significant.

Figs.1 and 2 reveal organic–minerals fertilization interaction effect on wheat and barley grain yield.

Statistical analysis of obtained data outlined a significant interaction between the studied organic fertilizer types and mineral fertilization dose regarding to barley grain yield where a non-significant interaction pattern was found regarding to wheat grain yield .

Data plotted in Figs 1and 2 reveal that chicken manure + 125% of recommended NPK treatment gives the heights values of wheat and barley grain yield, 2977.9 and 2818.1 Kg fed.$^{-1}$. respectively. These results are in a harmony trend with that of Antonio *et al*., (2013). They reported that the highest mineral fertilizer rate addition of biochar led to about 20–30 % increase in grain yield of wheat compared with the use of the mineral fertilizer alone. This fact was related to the own nature of biochar: low available nitrogen content, high adsorption capacity, and low mineralization rate for N; and alkaline pH and high carbonate content .

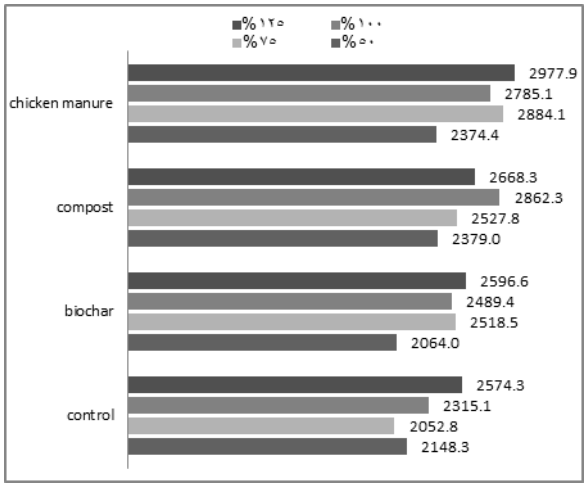

Fig. 1. Effect of organic – minerals fertilization interaction on wheat grain yield, kg. fed^{-1}.

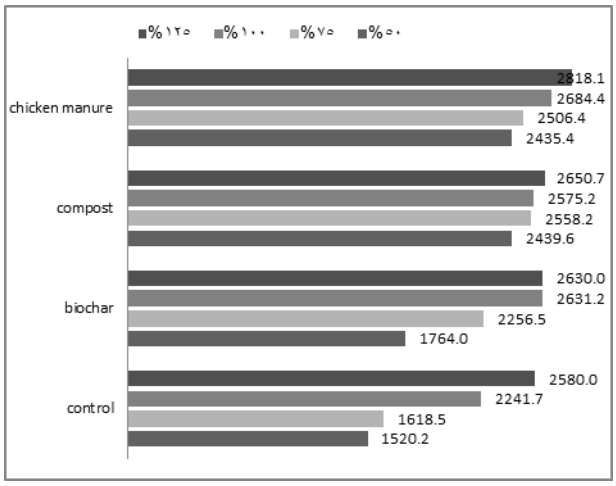

Fig. 2. Effect of organic – minerals fertilization interaction on barley grain yield, kg. fed^{-1}.

Data presented in Table 1 show the organic fertilizer types and mineral fertilization doses effect on wheat and barley straw yield where it were significantly affected by each of studied factor or levels.

Regarding to organic fertilizer types effect on straw yield, addition of any type increased straw yield of both wheat and barley compared with no addition. Biochar, compost and chicken manure addition led to increase wheat straw yield by 1.12, 16.90 and 23.96% compared with 0.0 organic addition, where the same amendment with the same order increased barley straw yield by 21.45, 28.65 and 41.44% compared with 0.0 organic addition. Hence the ability of tested organic material to increase straw yield was higher in barley than that of wheat. Chicken manure treatment recorded the highest straw yield, 4002.5 and 2511.3 Kg fed.$^{-1}$ of wheat and barley, respectively.

Data also declare that mineral fertilization increased wheat straw yield up to the highest level used, 125 % of recommended NPK. The highest increase of wheat straw yield was 23.32 % of that obtained with 50 % of recommended NPK. Barley straw yield was increased up to 100 % of recommended NPK then decreased after that. The highest increase in straw yield of barley was 39.53 % of that obtained with 50 % of recommended NPK.

The difference in wheat straw yield between 100 and 125 % of recommended NPK treatment means is not significant, while the difference between the same treatment means in barley straw is significant.

Figs. 3 and 4 reveal organic – minerals fertilization interaction effect of on wheat and barley straw yield. Statistical analysis outlined a significant interaction between the studied organic form and mineral fertilization dose regarding to wheat straw yield where a non-significant interaction effect was found regarding to barley straw yield .

Compost -125% of recommended NPK treatment gives the heights values of wheat straw yield 4249.0 Kg fed.$^{-1}$ .While Compost -100 % of recommended NPK treatment gives the heights values of barley straw yield 3531.3 Kg fed.$^{-1}$.

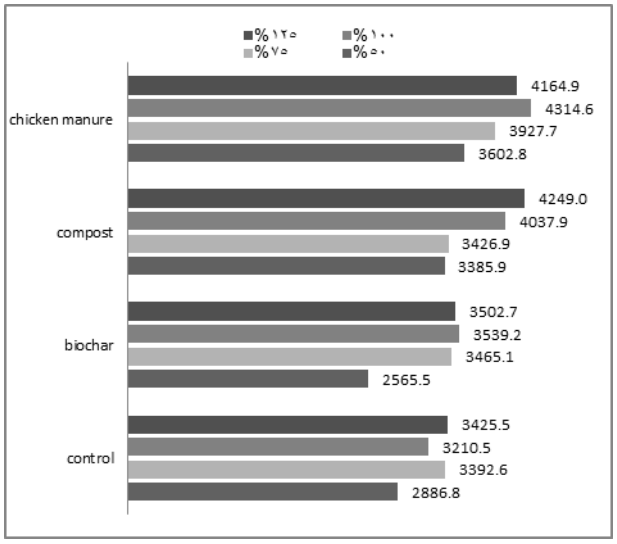

Fig. 3. Effect of organic – minerals fertilization interaction on wheat straw yield, kg. fed^{-1}.

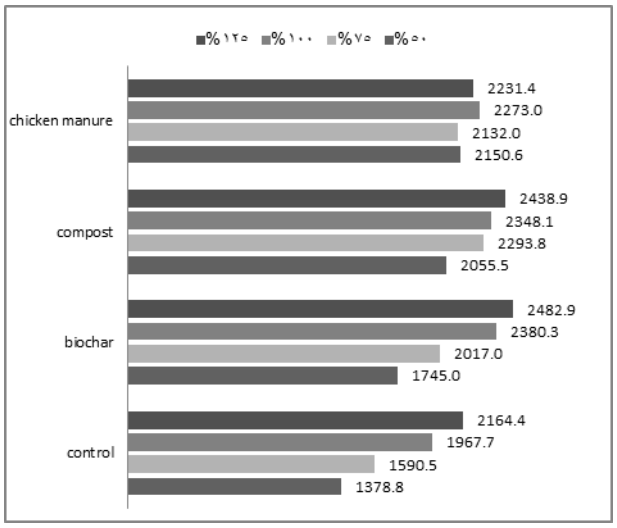

Fig. 4. Effect of organic – minerals fertilization interaction on barley straw yield, kg. fed^{-1}.

Data presented in Table 1 show the organic fertilizer types and mineral fertilization doses effect on 1000 grain weight of wheat and barley where it were significantly affected by each of studied factor and levels .

Data of Table 1 showed that among different addition of organic matter, chicken manure treatment recorded the highest values of 1000- grain weight of wheat, 50.53, and barley, 43.90 gm., respectively. The lowest values of 1000 grain weight was achieved under 0.0 organic matter (control),47.138 and 41.216 gm. for wheat and barley , respectively. These results are in agreement with that of Shaimaa *et al*., (2012). They outlined that compost addition increased 1000 grains weight of wheat than that of no compost addition . This effect resulted from soil structural or aggregate stability increase, soil bulk density decrease, Water holding capacity and plant available water increase (Martínez-Blanco *et al.*, 2013)

Mineral fertilization levels high significantly affected 1000 grain weight of both wheat and barley, The highest value of wheat , 50.48, and barley, 43.178, were obtained with 125% of recommended NPK fertilization treatments . The difference between means of 1000 grain weight of 100 and 125 % of recommended NPK for wheat is highly significant where the difference between means of that trait for the same treatments for barley is not significant .

Figs.5 and 6 reveal organic – minerals fertilization interaction effect of on 1000 grain weight of wheat and barley. Statistical analysis of obtained data outlined a significant interaction between the studied organic fertilizer types and mineral fertilization dose regarding to 1000 grain weight of wheat where a non-significant interaction pattern was found regarding to 1000 grain weight of barley.

Data plotted in Figs 5 and 6 reveal that chicken manure - 125% of recommended NPK treatment gives the heights values of wheat and barley 1000 grain weight , 51.600 and 44.655 gm, respectively.

Data presented in Table (2) show the effect of organic and mineral fertilization on NPK content of wheat and barley grains.

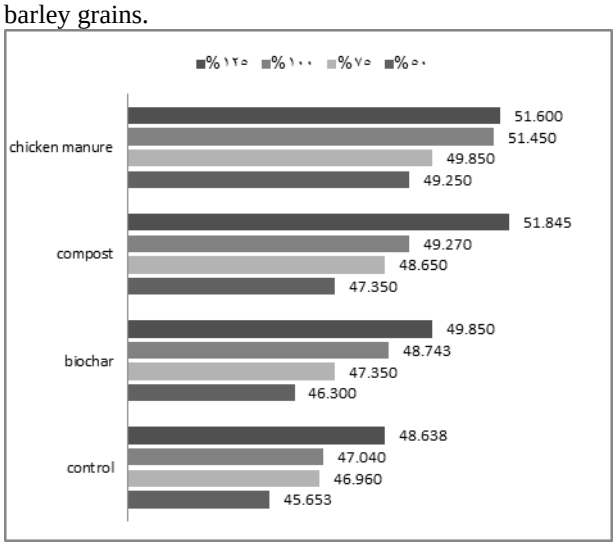

Fig. 5. Effect of organic – minerals fertilization interaction on 1000 grain weight, gm., of wheat.

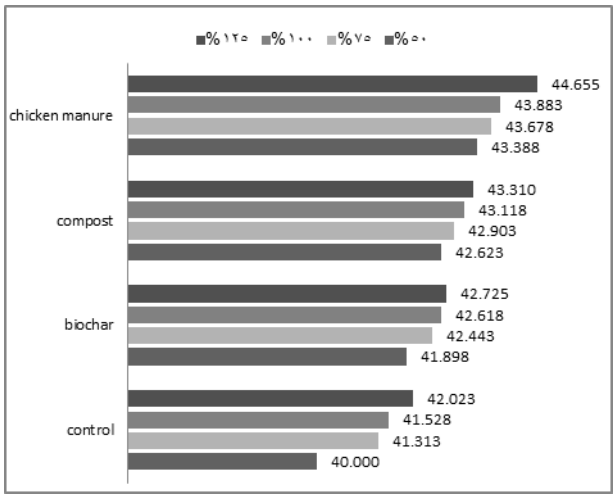

Fig. 6. Effect of organic – minerals fertilization interaction on 1000 grain weight gm., of barley

Data of table 2 reveal that all tested organic treatments significantly increased N content of wheat and Barely grains compared to control, 0.0 organic addition, where 0.0 organic, biochar, compost and chicken manure treatment means were, 1.358, 1.416, 1.525 and 1.611 % for wheat grain and 1.086, 1.315, 1.459 and 1.468 % for barley grains, respectively. Chicken manure treatment is superior one in this respect, where nitrogen content increase of wheat and barley grains amounted by 18.6 and 35.2 % compared with that of 0.0 organic treatment. These results are in accordance with Li *et al*,.(2011) finding. They studied the influence of poultry litter and livestock manure at a rate of 21 tons ha^{-1}, 54% and 60% moisture, with intensive farming on soil quality indicators. They showed that applied manure increased the microbial biomass C and total N contents (+89%, +74%) of soil.

Table 2. Effect of organic and mineral fertilization on NPK content of Wheat and Barely grain.

Characteristics	N%		P%		K%	
Treatments	**Wheat**	**Barely**	**Wheat**	**Barely**	**Wheat**	**Barely**
organic fertilizer treatments						
Control	1.358	1.086	0.236	0.212	0.192	0.445
Boichar	1.416	1.315	0.279	0.281	0.222	0.455
Compost	1.525	1.459	0.305	0.286	0.264	0.452
Chicken manure	1.611	1.468	0.318	0.319	0.316	0.517
LSD at 5%	0.054	0.114	0.010	0.007	0.008	0.016
F.test	**	**	**	**	**	**
mineral fertilizer treatments						
50%	1.337	1.174	0.232	0.253	0.207	0.423
75%	1.390	1.271	0.280	0.271	0.240	0.456
100%	1.544	1.394	0.306	0.281	0.264	0.484
125%	1.639	1.490	0.319	0.291	0.284	0.506
LSD at 5%	0.047	0.0785	0.007	0.00666	0.006	0.012
F.test	**	**	**	**	**	**

Data plotted in Table 2 also show that mineral fertilization significantly increased N content of wheat and barley grains. N content of wheat grains was recorded as 1.337, 1.390, 1.544 and 1.639 %, respectively, with mineral fertilization levels of 50, 75, 100 and 125% ,respectively. Similar values of barley grains were 1.174, 1.271, 1.394 and 1.490 respectively. Mineral fertilization level of 125% is superior treatment where the nitrogen content of wheat and barley grains were maximized, 22.5 and 26.9 % increase compared with that of 50% mineral fertilization treatments. These results are in agreement with that of Adeleye *et al*., (2010). They reported that poultry manure at 10 tons ha^{-1} increased total N of soil by 26.47 % than that of control treatment.

Figs.7and 8 reveal organic– minerals fertilization interaction effect on nitrogen content of wheat and barley grains.

Statistical analysis of obtained data outlined a significant interaction between the studied organic fertilizer types and mineral fertilization dose regarding to N content of wheat grains where a non-significant interaction pattern was found regarding to N content of barley grains.

Data plotted in Figs 7and 8 reveal that chicken manure - 125% of recommended NPK treatment gives the heights values of wheat and barley grains N content, 1.81 and 1.699 %. The lowest values were obtained with 0.0 organic matter - 50% of recommended NPK treatment, 1.22 and 0.908 % for wheat and barley, respectively.

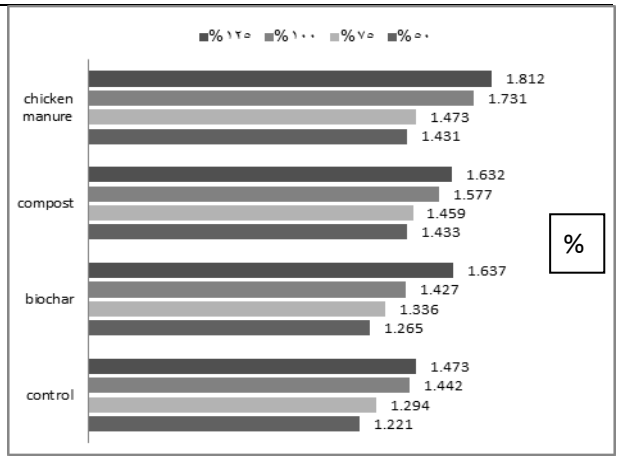

Fig. 7. Effect of organic – minerals fertilization interaction on N content of wheat grains

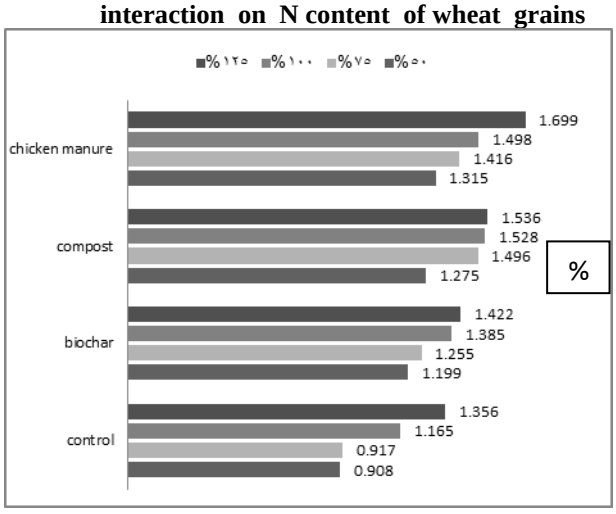

Fig. 8. Effect of organic – minerals fertilization interaction on N content of barley grains

Regarding to biochar, compost , chicken manure and mineral fertilization level effect on P content of wheat and barely grains data of Table 2 declare that biochar, compost and chicken manure increased P content of wheat grains compared with control, 0.0 organic matter. The percentage of increase were 18.0 , 29.0 and 34.0% compared with control treatment. Similar trend was also achieved with barley where The percentage of increase were 34.9, 34.9 and 49.0%, respectively, compared with control treatment . Chicken manure treatment achieved higher value of phosphorus content for both wheat and barley grains, 0.318 and 0.320 % , respectively. These results are in accordance with that of Fuentes *et al.,* (2006). They reported that chicken manure application increased total P in soil.

It is worthy to mention that the increment effect of organic matter addition on grain P content was higher with barley than that of wheat.

Mineral fertilization treatment increased P content of wheat and barley grains significantly. . Increasing mineral fertilization level from 50 % to 75% increased p content of wheat and barley by 20.0 and 8.0 %, respectively. . Increasing mineral fertilization level from 75 % to 100 % increased p content of wheat and barley by 9.0 and 3.0 %, respectively. . Increasing mineral fertilization level from 100 % to 125 % increased p content of wheat and barley by 4.0 and 3.0 %, respectively. Previous discussion reveal the descending increment due to the same increase in mineral dose .

Increasing mineral fertilization level from 50 % to 100 % increased p content of wheat and barley by 31.8 and 12.0 %, respectively. Increasing mineral fertilization level from 50 % to 125 % increased p content of wheat and barley by 37.5 and 16.0 %, respectively. So, it is worthy to mention that the mineral fertilization ability to increase wheat grain P content was higher than that of barley

Figs. 9 and 10 reveal organic – minerals fertilization interaction effect on phosphorus content of wheat and barley grains.

Statistical analysis of obtained data outlined a significant interaction between the studied organic fertilizer types and mineral fertilization dose regarding to P content of both wheat and barley grains.

Data plotted in Figs 9 and 10 reveal that chicken manure - 125% of recommended NPK treatment gives the heights values of wheat and barley grains P content, 0.372 and 0.334 %. The lowest values were obtained with 0.0 organic mater +50% of recommended NPK treatment, 0.214 and 0.178 % for wheat and barley, respectively.

In spite of the negative effect of biochar pH value compared with compost and chicken manure , P content of wheat and barley plant grains were increased due to biochar, compost and chicken manure addition alone or with mineral fertilizer under the study . These results are in a same trend with that of Dume *et al*., (2016). They reported that biochar application (15 tons ha^{-1}) did not increase significantly soil pH. However, relatively highest mean pH value was observed in the soil treated with biochar, while the lowest values were recorded in the control. Naramabuye and Haynes, (2005) reported that Addition of poultry manure (20 mg Kg^{-1})generally tended to reduce the pH range (4.0 and 4.5) but increase it in the higher range (pH 5.5 or 6.0 and above). Citak and Sonmez, (2011) examine the effects of different organic manures including farmyard manure, chicken manure and blood meal on soil pH and reported that chicken manure application gave rise to a decrease in soil pH, whereas farmyard manure caused soil pH to increase.

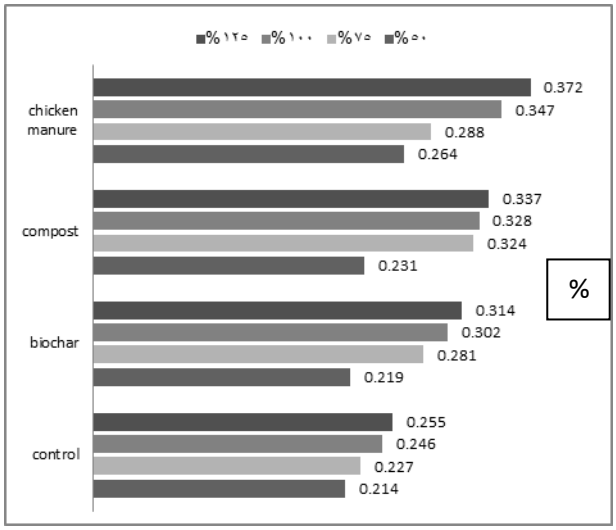

Fig. 9. Effect of organic – minerals fertilization interaction on P content of wheat grains

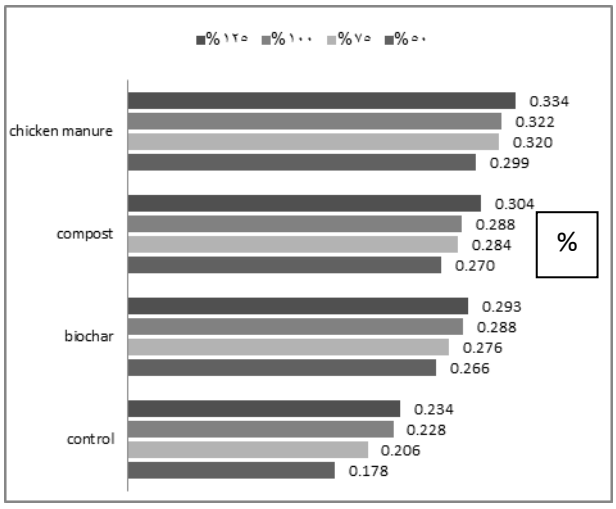

Fig. 10. Effect of organic – minerals fertilization interaction on P content of barley grains

Concerning to organic fertilizer types and mineral fertilization doses effects on K content of wheat and barley grains Data of Table 2 reveal that organic fertilizer Type high significantly affect potassium content of wheat and barley grain.

Very little increase but significant was found in K content of wheat and barley due to Appling biochar treatment, 5040.0 Kg fed^{-1}, compared to 0.0 organic treatment where potassium content of wheat grains was

increased from 0.192 to 0.222 % and potassium content of barley grains was increased from 0.445 to 0.455% .

Appreciated and significant increase was found in K content of wheat grains and very little increase was found in K content of barley grains as a result of compost, 10000 kg fed^{-1}, Appling treatment compared to 0.0 organic treatment where potassium content of wheat grains was increased from 0.192 to 0.264 %, 37.5 increase, and potassium content of barley grains was increased from 0.445 to 0.455%%, 2.25 increase. These results are in agreement with that of Zhao *et al.*,(2014). They outlined that biochar applications improved P and K availability, increased N, P and K uptake by wheat which reflex of N,P and K content of seed and grain ,also increased wheat and millet straw yields by 19.6 and 60.6%, respectively.

The highest values of K% are 0.316 and 0.517 (wheat and barley were recorded with chicken manure treatment compared with control treatment, 0.0 organic ,which recorded 0.192 and 0.445% as potassium content for wheat and barley grains, respectively. Chicken manure addition with 5000 Kg $fed.^{-1}$ increased potassium content of wheat and barley grains than that of 0.0 organic matter treatment by 64.50 and 16.17%

Data of Table also reveal that potassium content of wheat and barley were significantly affected by mineral fertilization levels. Appreciated and dramatically significant increase was found in K content of wheat grains with increasing mineral fertilization level up to the highest level used, where a very little steadily increase was found in K content of barley grains as a result of the same increase in mineral fertilization. K content of wheat grains were 0.207, 0.240, 0.264 and 0.284% for mineral fertilization treatment of 50, 75, 100 and 125 % NPK of recommended dose treatments, respectively. Similar values for barley are 0.423, 0.456, 0.484 and 0.506% for the same mineral fertilization treatments order

The highest value of K content for both wheat (0.284%) and barley (0.506%) were achieved with 125% of NPK of recommended dose treatment. The lowest value of that trait for wheat, 0.207 and barley, 0.423, were achieved with 50% of NPK recommended dose treatment. 125% of NPK recommendation dose treatment increased K content of wheat and barley grains by 37.1 and 19.6 compared with that of 50% mineral fertilization treatment .

Figs.11 and 12 reveal organic – minerals fertilization interaction effect of on potassium content of wheat and barley grains. A significant interaction between the studied organic fertilizer types and mineral fertilization dose regarding to K content of both wheat and barley grains.

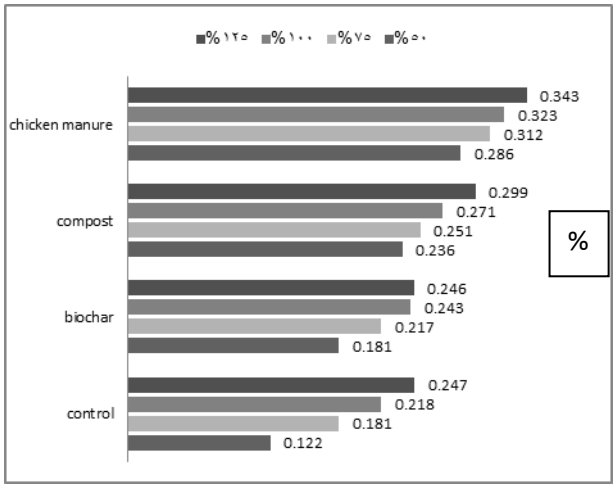

Fig. 11. Effect of organic – minerals fertilization interaction on K content of wheat grains.

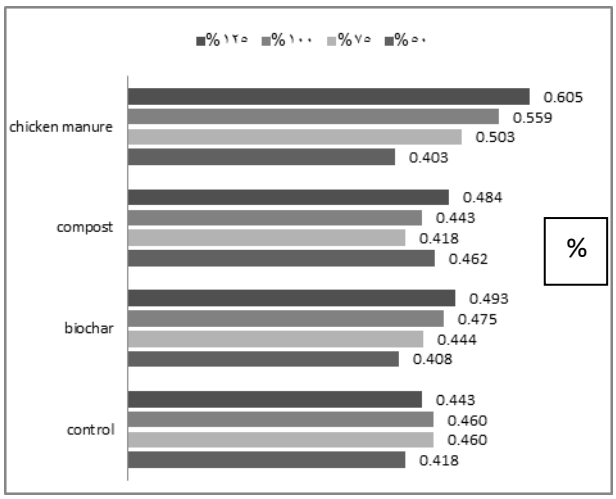

Fig. 12. Effect of organic – minerals fertilization interaction on K content of barley grains

Data plotted in Figs 11 and 12 reveal that chicken manure -125% of recommended NPK tratment gives the heights values of wheat and barley grains k content, 0.343 and 0.605 %.

CONCLUSION

It is worthy to conclude that under Egyptian conditions we can use Biochar as organic amendment to sandy soil without suffering from the negative effect of its pH value . The mineral fertilizer recommendation must be changed where the highest value of wheat and barley yield quality and quantity parameters were obtained under chicken manure addition plus 125% NPK of mineral fertilizers treatment , meaning that 125 % NPK of recommended alone did not sufficiency to yielded the highest yield .

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تأثير البيوشار والكمبوست وسبلة الدواجن والتسميد المعدنى على القمح والشعير النامى فى أرض رمليه .

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نفذت تجربتان حقليتان في شتاء 2015/2014 على محصولى القمح والشعير بمحطة التجارب والبحوث الزراعية بقلابشو التابعة لجامعة المنصورة بمحافظة الدقهلية فى قطاعات منشقه وتضمنت المعاملات إضافة مواد عضويه وهى الفحم و الكمبوست وسماد الدواجن و بدون إضافات عضويه وزعت على القطع الرئيسيه . أما القطع المنشقه تضمنت معاملات التسميد المعدنىNPK بمستويات 50 و 75 و 100 و 125 % من الموصى به . وكان من أهم النتائج المتحصل عليها مايلى : إضافة الفحم , الكمبوست وسماد الدواجن أدت الى زيادة إنتاجية القمح من الحبوب بما يعادل 6.36 و 14.92 و 21.21 % على التوالى مقارنة بالكنترول وقد وجد ان نفس المعاملات بنفس الترتيب السابق أدت إلى زيادة انتاجية الشعير من الحبوب بما يعادل 16.59 و 28.43 و 31.17 %.% وبالتالى فإن قدرة الأسمدة العضوية موضع الدراسة كانت أعلى في زيادة إنتاجية محصول الشعير عنها فى القمح. زادت إنتاجية محصول الحبوب في كلا القمح والشعير بزيادة التسميد المعدنى حتى أعلى معدل سمادى مستخدم (125 % من الموصى به). سجلت معاملة سماد الدواجن اعلى قيمة لإنتاجية القش 4002.5 كجم / فدان و 2511.3 كجم/فدان في القمح والشعير على التوالي ، كما سجلت نفس المعامله اعلى قيمة لوزن الألف حبة في القمح(50.35 جم)و في الشعير (43.90 جم)،كما أن التفاعل بين التسميد العضوى والتسميد المعدني كان معنويا فيما يتعلق بوزن الألف حبة في القمح بينما كان التفاعل غير معنوى بالنسبة للشعير قدرة سبلة الدواجن على رفع المحتوى النيتروجينى فى حبوب القمح والشعير كانت أعلى من غيرها من الأسمدة العضوية المضافه ، كما أن معاملة التسميد المعدنى 125 % من الموصى به سجلت اعلى القيم للمحتوى النتروجينى في حبوب القمح والشعير مقارنة بمستويات التسميد المعدنى الأخرى والتى شملتها الدراسه .معاملات الفحم و الكمبوست وسماد الدواجن أدت إلى زيادة محتوى الفوسفور في حبوب القمح بما يعادل 18.0 , 29.0 و 34.0 % مقارنة بالكنترول(0.0 ماده عضويه) كما أدت إلى زيادته أيضا فى الشعير بما يعادل 34.0 , 43.9 و 49.0 على التوالي .أدت زيادة مستوى السماد المعدني المضاف من 100 % الى 125 % إلى زياده بسيطه فى المحتوى الفوسفورى لحبوب كل من القمح والشعير 4.0 و3.0 % على التوالي . وجدت زيادة طفيفه ولكنها معنوية في المحتوى البوتاسيومى لحبوب كل من القمح والشعير نتيجة لاضافة الفحم مقارنة بالكنترول وكان أعلى محتوى بوتاسى لحبوب كل من القمح (0.284 %) والشعير(0.506 %) تحققت عند إضافة 125 % من الموصى به كأسمده معدنيه .