Egypt. J. Plant Breed. 26(1):127 – 155 (2022)

EFFECT OF MINERAL AND ORGANIC NITROGEN FERTILIZATION ON YIELD PRODUCTIVITY OF SOME BREAD WHEAT CULTIVARS AND IMPROVING THE SOIL SUSTAINABILITY

Shaimaa E. Ibrahim[1&*], Omnya M.A. Elmoselhy[1] and Rasha R. El-Khamisy[2]

1. Wheat Research Department, Field Crops Research Institute, ARC, Egypt
2. Soils, Water and Environment Res. Inst., ARC, Giza, Egypt.

*Corresponding Author: shaimaaeldesoky729@yahoo.com

ABSTRACT

Two field experiments were conducted at El-Gemmeiza Agricultural Research Station, ARC, Egypt during the two growing seasons of 2019/2020 and 2020/2021 to elucidate the effects of the combined application of mineral and organic fertilizers on some bread wheat cultivars for increasing the yield productivity and improving the soil sustainability. A split plot design in a randomized complete block arrangement was used with three replications. Main plots were allocated to the three bread wheat cultivars (Gemmieza 12, Sakha 95 and Misr 3), and the four combinations of inorganic and organic fertilizer treatments were assigned to the sub plots. The results showed that application of nitrogen and compost sources either alone or in combination had highly significant effects on grain yield and its attributes across the two seasons. The bread wheat cultivar Sakha 95 was significantly superior to the other cultivars in grain yield (3.71 ton fed^{-1}). The three bread wheat cultivars fertilized with 75% of the recommended dose of N plus compost application of 2 ton fed^{-1} exhibited the highest grain and straw yields. Highly significant and positive correlation coefficients were detected between 1000 kernel weight, grain and straw yield. The results cleared that, application of organic N plus 75 or 50% of the recommend mineral nitrogen dose to the soil reduced the values of soil bulk density and soil pH and increased total porosity, hydraulic conductivity, available NPK, organic matter, NPK-uptake in both grain and straw yield and protein content in grains.

Key words: ***Wheat (Triticum aestivum L.), Nitrogen fertilizer, Compost, Soil sustainability.***

INTRODUCTION

Wheat is one of the main food crop grains over the whole world and Egypt. This may be due to its wide adaptability to different agro climatic conditions and different types of soils (Mohamed *et al*, 2021). In Egypt, wheat is cultivated on the area of 1.42 million hectares with a yearly production around 9 million tons with an average yield of 6.85 ton ha^{-1} (Economic Affaira Sector, 2021). Egypt remains the largest world's wheat importer. Wheat imports were about 13 million tons (FAO 2020). The national production of wheat is proportionally lower than the consumption demands. Therefore, the principal challenges for future is to further develop wheat efficiency to diminish the gap between production and consumption. Increasing wheat production could be possible through increasing the wheat-cultivated area and releasing high-yielding cultivars adapted to the

Egyptian environments coupled with improved agronomic practices such as nitrogen fertilizer application.

Fertilizers are materials applied to the soil to increment crop yield by providing at least one of the essential plant nutrients. Nitrogen a fundamental macronutrient that assumes a major part in plant development and it is viewed as the main manure required for expanding yield in most fundamental field crops as wheat. Utilizing mineral fertilization seems to be a very fast and effective strategy but it costs very high as well as ecological concerns. Usage of mineral fertilizers for quite a long time with next to no enhancements of natural sources resulting in most deficiency of nutrients in soil, which diminished the productivity and quality of field crops and causing soil and water contamination. Diminishing how much the amount of mineral nitrogen fertilizer applied to the soil without the negative nitrogen deficit will be the principal challenge in field management. Reusing of organic wastes is considered one of potential choices to lessen the utilization of mineral fertilizers.

Wastes from plants and animals are referred to as organic manure. The great importance of organic fertilizer is that it contains little or no soluble salt and it is applied in a large quantity without the risk of harming crop roots .Besides microorganisms in the soil help to break the organic materials into inorganic water-soluble forms for plant use (Hignette 1999). Use of organic wastes could increment soil organic matter, buffer the soil, improve aggregate stability and improve water retention capacity (Spaccini *et al* 2002 and Abd Elgalil and Abdel-Gawad 2020).

Compost is a combination that rich source of supplements, contains decayed organic matter, and is utilized for fertilizing. The Physical and chemical properties of the soil can be improved by utilizing compost, which may eventually increment crop yields. Compost decreases the economic load of buying chemical fertilizers and can decline the ecological effects related with the production of chemical fertilizers and application. The use of compost as organic fertilizers can diminish reliance on chemical nutrients and develop crop production (Tubeileh and Stephenson 2020). Also, compost items can be utilized as soil changes for further developing soil quality and crop productivity (Ding *et al* 2021).

The integration of nitrogen fertilizer with bioorganic fertilizers could be positively effective in wheat production (Agegnehu *et al* 2014, Zemichael and Dechassa 2016 and Ismail and Moursy 2018). (Abd El-Gawad and Morsy 2017) reported that the combination of organic and inorganic fertilizer was superior to utilize organic or inorganic fertilizer independently. In addition, Chen *et al* (2018) expressed that organic and inorganic fertilizer could increment wheat yield and its stability by developing soil richness and limiting vulnerability to environmental change.

The target of this study was to elucidate the explain the impacts of the combined utilization of inorganic and organic fertilizers on some bread wheat cultivars for expanding their yield productivity and improving of the soil sustainability under the ecological conditions of Middle Delta region.

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental farm of El Gemmieza Agricultural Research Station, El Gharbiah Governorate (30.78913°N, 31.12187°E), Agriculture Research Center, Egypt during the two continuous growing seasons of 2019/2020 and 2020/2021. Three high-yielding bread wheat cultivars namely, Gemmeiza 12, Sakha 95 and Misr 3 were used in this study. The pedigree, selection history and origin of the three bread wheat cultivars are introduced in Table 1.

Table 1. The pedigree, selection history and origin of the three bread wheat cultivars used in this study.

No.	Pedigree and selection history	Origin
Gemmeiza 12	OTUS/3/SARA/THB//VEE CCMSS97Y00227S-5Y-010M-010Y-010M-2Y-1M-0Y-0GM	EGYPT
Sakha 95	PASTOR//SITE/MO/3/CHEN/AEGILOPSSQUARROSA (TAUS)//BCN/4/WBLL1 CMSA01Y00158S-040P0Y-040M-030ZTM-040SY-26M-0Y-0SY-0S	
Misr 3	ATTILA *2/PBW65*2/KACHU CMSS06Y00582T099TOPM-099Y099ZTM-099Y099M-10WGY-0B0- 0EGY	

Experimental design and treatments

A split plot design in a randomized complete block arrangement was utilized with three replications. Main plots were allocated to the three bread wheat cultivars (Gemmieza 12, Sakha 95 and Misr 3), and the four combinations of inorganic and organic fertilizer treatments (T1, 100% of the recommended dose of mineral N (75 Kg N fed^{-1}), T2, 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1}, T3, 50% of the recommended dose of mineral N (37.50 kg N fed^{-1}) + compost application at 2 ton fed^{-1} and T4, 25% of the recommended dose of mineral N (18.75 kg N fed^{-1}) + compost application at 2 ton fed^{-1}) were assigned to the sub plots. The sub plot area was 4.8m^2 with 6 rows, 4 m long and 20 cm apart. The wheat grains were planted in 25th and 29th November in both growing seasons, respectively with seeding rate of 60 kg fed^{-1}. Calcium super phosphate fertilizer (15% P_2O_5) at the rate of 100 kg P_2O_5 fed^{-1} was applied during seedbed preparation. Mineral nitrogen was added at the rate of 163 kg N fed^{-1} for control (100% nitrogen fertilization as a recommended dose) in the form of urea (46.6 % N) in two equal doses. Applying the first dose of N fertilizer was before the first irrigation (25 days from planting), and the second one was before the second irrigation. The organic fertilizer (compost) was added before planting during seedbed preparation. The compost was gotten from Quesna Agricultural Development Company, Egypt. Two ridges were conducted to avoid cross contamination among plots separated each plot. Soil samples from the exploratory site were taken from surface layer (0-30cm) to determine main physical and chemical characteristics. Soil moisture contents, particle size analysis, and some chemical properties were determined according to Page *et al* (1982) and Klute (1986 a and b) and the values are listed in Tables 2 and 3, respectively. Soil samples from the experimental site were collected at the depth of (0-30 cm) from all plots. Samples were allowed to dry under shade, then ground and sieved to pass through a 2 mm sieve. Soil physical properties i.e., total porosity and hydraulic conductivity were measured and their relations to crop production for the two years were calculated as outlined by Klute (1986 a and b). Soil samples were analyzed for some chemical properties as indicated A.O.A.C. (2012).

Table 2. Some chemical and physical properties of investigated soil.

Parameters		Values	
		2019/2020	2020/2021
Chemical properties	Soil pH (1:2.5)	8.09	8.14
	EC (dSm^{-1})	0.92	1.08
Available macronutrients	N (mg kg^{-1})	41.05	36.95
	P (mg kg^{-1})	2.85	3.65
	K (mg kg^{-1})	388	365
Soluble cations and anions (cnnol kg-1 soil)	Ca2+	1.95	2.25
	$Mg2^{+}$	2.35	2.65
	Na^{+}	4.4	5.35
	K^{+}	0.21	0.18
	Cl^{-}	3.05	4.65
	$CO3^{--}$	Nil	Nil
	$HCO3^{-}$	3.95	4.86
	$SO4^{-}$	1.91	0.92
Hydraulic conductivity (cm h^{-1})		0.91	0.78
Particle size distribution	Coarse sand	9.75	6.15
	Fine sand	15.65	11.75
	Silt	25.52	30.69
	clay	49.08	51.41
Texture		Clayey	Clayey

Table 3. Soil moisture constants and bulk density values of the soil at the experimental site.

Depth	2019/2020			
	Field capacity%	Wilting point %	Available moisture %	Bulk density (g cm-3)
0-15 cm	45.24	24.05	21.19	1.25
15-30 cm	43.95	22.9	21.05	1.28
30-45 cm	41.15	22.45	18.7	1.29
45-60cm	40.88	21.99	18.89	1.36
Average	42.81	22.85	19.96	1.3
Depth	2020/2021			
	Field capacity %FC	Wilting point %	Available moisture %	Bulk density (g cm-3)Bd
0-15 cm	44.15	23.98	20.17	1.21
15-30 cm	44.05	23.49	20.56	1.24
30-45 cm	42.11	22.09	20.02	1.28
45-60cm	40.09	21.65	18.44	1.33
Average	42.6	22.8	19.8	1.27

Soil pH was determined in a 1:2.5 ratio (soil/water.). The total soluble salts (EC) were resolved utilizing electrical conductivity meter at 25°C in soil paste extract as dsm^{-1}. Organic matter (OM) was determined according to (Walkley and Black 1934). Available N, P and K of the soil was removed by KCl (2M), $NaHCO_3$ (0.5M) and CH_3COONH_4 (1M), respectively. N P K uptake, Nutrient uptake was calculated in grains and straw (Nutrient element uptake kg fed^{-1} = (Nutrient element% + Yield (kg fed^{-1})/100). Particle size distribution was carried out by the Pipette method depicted by (Sheldrick and Wang 1993). The core method (Blake and Hartage 1986) was used to determine bulk density for soil. Plant samples (grain and straw) were oven dried at 70 ˚C until steady dry weight, then ground and processed utilizing H_2SO_4 and $HClO_4$ mixture. Nitrogen percentage in the grains was settled by utilizing the micro-Kjeldahl method and then multiplied by the factor (5.75) to obtain the grain protein percentage according to A.O.A.C. (1990). Other than measurements of P was done calorimetrically utilizing ascorbic acid, while K was estimated by flame photometer as described by Cottenie *et al* (1982). Compost samples were subjected to investigate the chemical composition according to Page *et al* (1982) and introduced in Table 4.

Studied traits

At harvest, spikes m^{-2} number was counted, ten spikes were taken haphazardly from each plot to appraise kernels $spike^{-1}$ number and 1000 kernel weight. Thereafter, two external rows from each plot were eliminated to avoid the border effect. Thus, four rows were harvested, and their biological yield were weighted after threshing straw and grain yields were estimated and adjusted to ton fed^{-1}. Harvest index (%) was assessed and changed in accordance with Hühn (1990) as follow:

$$HI\% = \frac{\text{Grain yield (kg /fed)}}{\text{Grain yield (kg/ fed)} + \text{Straw yield (kg /fed)}} x100$$

Table 4. Some characteristics of the compost used in this study.

Season	pH (1:10)	EC (1:10) dS m^{-1}	Bulk density (g cm^{-3})	Total N (%)	Total P (%)	Total K (%)	Organic matter (%)
2019/2020	7.15	1.69	0.68	1.64	0.43	1.1	24.18
2020/2021	7.22	2.02	0.71	1.44	0.51	1.23	20.09

Statistical analysis

The obtained data of the two seasons and their combined were statistically analyzed according to Gomez and Gomez (1984) using Statistical Package for Social Sciences (SPSS) software (version 25). Differences among means were tested utilizing the least significant difference (LSD) at 0.05 and 0.01 level of probability. The error mean squares of split plot design were homogenous according to Levene (1960), the combined analysis was performed for all the studied traits in both seasons.

RESULTS AND DISCUSSION

The combined analysis across the two seasons in Table (5), revealed that the effects of cultivars and treatments were highly significant ($P<0.05$) for all the studied traits. In addition, the effects of interaction between cultivars and treatments were highly significant for all the studied traits except straw yield (ton $fed^{-1)}$. This study clearly indicated that wheat productivity was significantly affected by different treatments applied. Thus, application of mineral nitrogen and compost sources either alone or in combination had highly significant effects on all the studied traits across the two seasons.

Table 5. Plant height, grain yield and yield components, straw yield and harvest index affected by cultivars, treatments and their interaction across the two seasons.

Cultivars	Plant height (cm)	Number of spikes m^{-2}	Number of kernels $spike^{-1}$	1000 kernel weight (g)	Grain yield ton fed^{-1}	Straw yield ton fed^{-1}	Harvest index (%)
Gemmeiza 12	109	349	64	39.35	3.59	6.44	36.02
Sakha 95	110	401	57	44.29	3.71	7.75	32.46
Misr 3	100	416	56	50.99	3.53	7.80	31.32
F test	**	**	**	**	**	**	**
LSD 0.05	0.9	9.13	2.31	0.8	0.11	0.48	1.92
Treatments	**Plant height (cm)**	**Number of spikes m^{-2}**	**Number of kernels $spike^{-1}$**	**1000 kernel weight (g)**	**Grain yield ton fed^{-1}**	**Straw yield ton fed^{-1}**	**Harvest index (%)**
T1	111	410	64	47.67	3.96	7.84	33.84
T2	109	415	65	46.32	4.21	8.93	31.83
T3	105	378	56	43.70	3.38	6.93	33.23
T4	101	352	51	41.82	2.89	5.62	34.17
F test	**	**	**	**	**	**	**
LSD 0.05	1	10.54	2.67	0.93	0.13	0.55	2.22
Interaction							
Cultivar * Treatment	**	**	**	**	**	Ns	**

*** and **. Significant at the 0.05 and 0.01 level, respectively. Ns: not significant.**

T1: 100% of the recommended dose of N (75 kg N fed^{-1}), T2: 75% of the recommended dose of N (56.25 kg N fed^{-1}) + compost application at 2 ton $fed^{-1,}$ T3: 50% of the recommended dose of N (37.50 kg N fed^{-1}) + compost application at 2 ton fed^{-1}, T4: 25% of the recommended dose of N (18.75 kg N fed^{-1}) + compost application at 2 ton fed^{-1}

Effect of cultivars

The results presented in Table (5) introduced highly significant differences among cultivars for plant height, yield and its components, straw yield and harvest index in the combined analysis across both seasons. The results also showed the superiority of the cultivar Misr 3 for number of spikes m^{-2}, 1000 kernel weight and straw yield (ton fed^{-1}). The wheat cultivar Sakha 95 significantly surpassed the other cultivars in grain yield (3.71 ton fed^{-1}), whereas, Gemmeiza 12 showed better performance ($P \leq 0.05$) in number of kernels $spike^{-1}$ (64). The differences in yield and its components among the evaluated three bread wheat cultivars might be attributed to their diversity in genetic background. Abo-Elela *et al* (2015) and El-Sorady *et al* (2022) found similar results.

Effect of treatments

Results introduced in Table (5) demonstrated that, the four studied treatments had highly significant effects on all the studied traits across the two seasons. Application of 100% of the recommended dose of N (T1) significantly increased plant height and 1000 kernel weight, whereas, application of 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2) significantly increased both grain and straw yields (ton fed^{-1}). On the other hand, a non-significant difference was recorded between 100% of the recommended dose of mineral N (T1) and 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2) which produced the highest spikes m^{-2} number and kernels $spike^{-1}$ number. In contrast, application of 25% of the recommended dose of mineral N (18.75 kg N $fed.^{-1}$) + compost application at 2 ton fed^{-1} (T4) exhibited the lowest values of plant height, number of spikes m^{-2}, number of kernels $spike^{-1}$, 1000 kernel weight, grain and straw yields. Maximum values of spikes m^{-2} number, kernels $spike^{-1}$ number, grain yield and straw yield were produced by applying 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2), while minimum values were recorded with applying 25% of the recommended dose of mineral N (18.75 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T4). Many researchers reported that nitrogen combination treatments (mineral and organic fertilizers) significantly improved yield and its attributes of wheat (Abo- Elela *et al* 2015, Khan *et al* 2016, Aksu 2017, Jamal and Fawad 2018 and Al- Sayed *et al* 2019).

Effect of the interaction:

As displayed in Table (6), the interaction among cultivars and nitrogen combination treatments had significant effects on all the studied traits across both seasons except straw yield (ton fed.$^{-1}$). The interactions of cultivars with nitrogen combination treatments revealed that, the two bread wheat cultivars Sakha 95 and Gemmeiza 12 combined with 100% of the recommended dose of mineral N (T1) recorded the highest values of plant height 116 and 114 cm, respectively. In contrast, the interaction effects of 50% of the recommended dose of mineral N (37.50 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T3) and 25% of the recommended dose of mineral N (18.75 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T4) with the cultivar Misr 3 exhibited non-significant shortest plants being 97 and 95cm, respectively. Regarding the number of spikes m^{-2}, maximum number of spikes m^{-2} were produced by the two bread wheat cultivars Sakha 95 and Misr 3 when applying 100% of the recommended dose of mineral N (T1) and 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2) without significant differences. The highest number of kernels spike^{-1} was obtained when the cultivar Gemmeiza 12 received 100% of the recommended dose of mineral N (T1) and 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2) without significant differences between both treatments. Concerning 1000 kernel weight, the bread wheat cultivar Misr 3 along with 100% of the recommended dose of mineral N (T1) gave heavier 1000 kernel weight and was statistically similar to that of 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2). On the other hand, the interaction effects of 25% of the recommended dose of mineral N (18.75 kg N fed.$^{-1}$) + compost application at 2 ton fed^{-1} (T4) gave the lowest 1000 kernel weight across the two seasons for the two cultivars Sakha 95 and Gemmeiza 12. The three wheat cultivars Sakha 95, Misr 3 and Gemmeiza 12 along with 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at

2 ton fed^{-1} (T2) exhibited the highest grain and straw yields (4.39, 4.21 and 4.11 ton fed^{-1}) and (9.32, 9.15 and 8.89 ton fed^{-1}), respectively.

Table 6. Plant height, grain yield and yield components, straw yield and harvest index affected by cultivars × treatments interaction across the two seasons.

Cultivars	Treatment	Plant Height (cm)	Number of spikes m^{-2}	Number of kernels $spike^{-1}$	1000 kernel weight (g)	Grain yield ton fed^{-1}	Straw yield ton fed^{-1}	Harvest index%
Gemmeiza 12	T1	114	371	68	42.04	3.94	6.91	36.57
	T2	112	376	70	40.40	4.11	8.89	31.91
	T3	108	342	60	38.20	3.38	5.71	37.82
	T4	103	308	60	36.77	2.90	4.81	37.47
Sakha 95	T1	116	423	64	48.08	4.10	8.45	33.01
	T2	112	438	64	46.27	4.39	9.32	32.21
	T3	109	384	54	42.90	3.49	7.53	31.82
	T4	106	360	49	39.90	2.85	5.87	32.80
Misr 3	T1	104	436	61	52.88	3.80	8.24	31.92
	T2	102	432	62	52.29	4.21	9.15	31.04
	T3	97	409	54	50.01	3.26	7.64	30.06
	T4	95	388	46	48.80	2.91	6.18	32.23
LSD 0.05. Cultivar* Treatment		1.716	25.818	4.628	1.61	0.23	Ns	3.85

T1: 100% of the recommended dose of N (75 kg N $fed^{-1)}$.
T2: 75% of the recommended dose of N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.
T3: 50% of the recommended dose of N (37.50 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.
T4: 25% of the recommended dose of N (18.75 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.
Ns: not significant.

In contrast, the interaction effects of 25% of the recommended dose of mineral N (18.75 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T4) with the three cultivars Sakha 95, Misr 3 and Gemmeiza 12 gave the lowest grain and straw yields. The highest grain yield achieved in case of T2 treatment may be attributed to the advantageous impact of compost on grain and straw readily available nutrients in the mineral fertilizers, while the more slow disintegration of mobilization of mineral nutrients from the organic sources, which is closely related to the quantity of fixed forms of N and then improve the translocation of the assimilates to sink organs and thus improve yield attributes and enhance the biological and physical proprieties of the soil. Abo-Elela *et al* (2015) identified comparative conclusion.

Correlation coefficients

In the current study, findings of the Pearson correlation analysis among the studied traits revealed significant correlations between grain yield and its attributes, such as plant height, spikes m^{-2} number, kernels spike^{-1} number, 1000 kernel weight, straw yield and harvest index Table (7). The correlation coefficients were viewed to be highly significant, strong and positive between plant height and number of kernels spike^{-1} and grain yield with values 0.585 and 0.620, respectively. Meanwhile, the correlations were highly significant between number of spikes m^{-2} and 1000 kernel weight (0.800), grain yield (0.586) and straw yield (0.698). Data showed highly significant and positive correlation between1000 kernel weight and each of grain, and straw yield (0.344 and 0.622). Likewise, high positive correlation was detected between grain yield and straw yield (0.746). The highly significant and negative correlation was found between 1000 kernel weight and harvest index (-0.528). What's more between straw yield and harvest index being (-0.695). These traits are important for selecting and improving grain yield. Effective breeding of high-yielding genotypes is based on the yield contributing characteristics and utilizing a few number of such important traits, which had a positive correlation with yield. Our results are in concurrence with Akram *et al* (2008), Ojha (2012) and El-Sorady *et al* (2022).

Table 7. Pearson's correlation coefficients among the studied traits across cultivars and fertilizer combinations.

Traits	Plant height	Number of spikes m^{-2}	Number of kernels $spike^{-1}$	1000 kernel weight (g)	Grain yield ton fed^{-1}	Straw yield ton fed^{-1}	Harvest index%
Plant height	1	0.034	0.585^{**}	-0.292^{*}	0.620^{**}	0.283^{*}	0.197
Number of spikes m^{-2}		1	0.088	0.800^{**}	0.586^{**}	0.698^{**}	-0.417^{**}
Number of kernels $spike^{-1}$			1	-0.085	0.600^{**}	0.325^{**}	0.113
1000 kernel weight (g)				1	0.344^{**}	0.622^{**}	-0.528^{**}
Grain yield ton fed^{-1}					1	0.746^{**}	-0.079
Straw yield ton fed^{-1}						1	-0.695^{**}
Harvest index %							1

***, **, Significant at 5% ($p \leq 0.05$) and at 1% ($p \leq 0.01$) probability level, respectively.**

Soil physical properties

Results presented in Table (8), revealed that, bulk density, total porosity and hydraulic conductivity were significantly affected by mineral nitrogen and compost combination treatments in both seasons. Bulk density was significantly decreased by applying 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2) and 50% of the recommended dose of mineral N (37.50 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T3). The lowest values of bulk density were recorded at T2 and T3 in both seasons (1.08 and 1.11 g cm^{-1}) and (1.11 and 1.15 g cm^{-1}), respectively. On the other hand, the values of total porosity and hydraulic conductivity were increased by applying T2 and T3.This increase was higher for T2 and T3 than for T1.

Table 8. Bulk density, total porosity and hydraulic conductivity as affected by cultivars, nitrogen combination treatments and their interaction after harvest of wheat in 2019/2020 and 2020/2021 growing seasons.

	2019-2020			2020-2021		
Cultivars	**Bulk density ($g\ cm^{-1}$)**	**Total porosity (%)**	**Hydraulic conductivity (cm/hr)**	**Bulk density ($g\ cm^{-1}$)**	**Total porosity (%)**	**Hydraulic conductivity (cm/hr)**
Gemmeiza 12	**1.14**	**57.17**	**1.12**	**1.18**	**55.31**	**1.62**
Sakha 95	**1.13**	**57.45**	**1.09**	**1.17**	**55.76**	**1.78**
Misr 3	**1.15**	**56.45**	**1.24**	**1.17**	**55.79**	**1.90**
LSD 0.05	**0.015**	**0.58**	**0.11**	**Ns**	**Ns**	**0.17**
Mineral and organic fertilizer	**Bulk density ($g\ cm^{-1}$)**	**Total porosity (%)**	**Hydraulic conductivity (cm/hr)**	**Bulk density ($g\ cm^{-1}$)**	**Total porosity (%)**	**Hydraulic conductivity (cm/hr)**
T1	**1.22**	**53.96**	**0.86**	**1.26**	**52.28**	**1.23**
T2	**1.08**	**59.37**	**1.40**	**1.11**	**57.99**	**2.17**
T3	**1.11**	**57.99**	**1.26**	**1.15**	**56.52**	**1.94**
T4	**1.15**	**56.77**	**1.07**	**1.17**	**55.68**	**1.73**
LSD 0.05	**0.026**	**0.99**	**0.06**	**0.021**	**0.80**	**0.12**

Table 8. Cont.

Cultivars * Treatments		2019-2020			2020-2021		
		Bulk density (g cm^{-1})	Total porosity (%)	Hydraulic conductivity (cm/hr)	Bulk density (g cm^{6})	Total porosity (%)	Hydraulic conductivity (cm/hr)
Gemmeiza 12	T1	1.19	55.09	0.85	1.27	52.08	1.14
	T2	1.09	58.87	1.4	1.12	57.74	2.07
	T3	1.13	57.36	1.21	1.16	56.23	1.81
	T4	1.14	56.98	1.03	1.19	55.09	1.48
Sakha 95	T1	1.23	53.58	0.82	1.27	52.08	1.28
	T2	1.05	60.38	1.35	1.12	57.74	2.41
	T3	1.1	58.49	1.23	1.14	56.98	2.07
	T4	1.13	57.36	0.96	1.16	56.23	1.82
Misr 3	T1	1.24	53.21	0.91	1.25	52.83	1.26
	T2	1.09	58.87	0.45	1.10	58.49	2.03
	T3	1.13	57.36	1.35	1.16	56.23	1.94
	T4	1.16	56.23	1.23	1.17	55.85	1.88
L.S.D. 0.05		Ns	Ns	Ns	Ns	Ns	Ns

T1: 100% of the recommended dose of N (75 kg N fed$^{-1)}$.
T2: 75% of the recommended dose of N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.
T3: 50% of the recommended dose of N (37.50 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.
T4: 25% of the recommended dose of N (18.75 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.

The highest values of total porosity and hydraulic conductivity were detected at T2 in both seasons (59.37 and 57.99 %) and (1.40 and 2.17 cm/hr), respectively, whereas, the lowest values were recorded at T1 in both seasons (53.96 and 52.28%) and (0.86 and 1.23 cm/hr), respectively. The three wheat cultivars along with 100% of the recommended dose of mineral N (T1) gave the highest bulk density in both seasons. In contrast, the interaction effects of 75% of the recommended dose of mineral N (56.25 kg

N fed^{-1}) + compost application at 2 ton fed^{-1} (T2) with the three wheat cultivars gave the lowest bulk density in both seasons. Maximum values of total porosity and hydraulic conductivity were produced by the two wheat cultivars Gemmeiza 12 and Sakha 95 when applying 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2) in both seasons. It very well may be presumed that, application of organic N with 75 or 50% recommend mineral nitrogen dose to the soil reduced the values of soil bulk density, and consequently increased total porosity and hydraulic conductivity. Therefore, total porosity and hydraulic conductivity have negatively related with soil bulk density. These outcomes are in harmony with Ahmed *et al* (2014). The results can be attributed to the importance of compost, which is an important source of nutrients as well as it contains largely decayed organic matter. Compost alongside increment of soil organic matter likewise works on the physical and chemical properties of soil and it finally resulted in expanded yield of wheat.

Soil chemical properties.

As displayed in Table (9), soil pH, available NPK and organic matter were significantly impacted by mineral nitrogen and compost combination treatments in both seasons. Whereas, the interaction among cultivars and nitrogen combination treatments was insignificant for these traits. Soil pH altogether diminished by applying 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2). The least values of soil pH were recorded at T2 in both seasons (7.80 and 7.87), respectively. Ahmed *et al* (2014) and Iqbal *et al* (2020) distinguished comparative trends. The values of soil available NPK content and organic matter were significantly increased by applying 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed.$^{-1}$ (T2) and 50% of the recommended dose of mineral N (37.50 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T3) without significant differences between both treatments. The highest values of soil available NPK content and organic matter were recorded at T2 and T3 in both seasons, while the lowest values of these traits were recorded at T1 in both seasons.

Table 9. Soil pH, available NPK and organic matter affected by cultivars, nitrogen combination treatments and their interaction after harvest wheat in 2019/2020 and 2020/2021 growing seasons.

		2019-2020				
Cultivars		**Soil pH**	**NPK available (mg Kg^{-1})**			**Organic matter (%)**
			N	**P**	**K**	
Gemmeiza 12		**7.90**	**59.33**	**5.76**	**480.58**	**2.09**
Sakha 95		**7.86**	**54.90**	**5.88**	**486.50**	**1.96**
Misr 3		**7.92**	**62.94**	**6.24**	**494.42**	**1.89**
L.S.D. 0.05		**Ns**	**3.22**	**0.29**	**Ns**	**486.50**
mineral and organic fertilizer		**pH**	**NPK available (mg Kg^{-1})**			**Organic matter (%)**
			N	**P**	**K**	
T1		**8.01**	**48.95**	**4.42**	**422.78**	**1.81**
T2		**7.80**	**67.57**	**7.12**	**542.22**	**2.09**
T3		**7.85**	**64.36**	**6.72**	**524.22**	**2.06**
T4		**7.91**	**55.35**	**5.59**	**459.44**	**1.96**
LSD 0.05		**0.05**	**4.24**	**0.54**	**30.33**	**0.15**
Cultivars * Treatments		**Soil pH**	**NPK available (mg Kg^{-1})**			**Organic matter (%)**
			N	**P**	**K**	
Gemmeiza 12	**T1**	**8.01**	**49.45**	**4.06**	**432.33**	**1.88**
	T2	**7.82**	**68.46**	**6.86**	**528.33**	**2.21**
	T3	**7.83**	**63.96**	**6.58**	**508.33**	**2.21**
	T4	**7.93**	**55.45**	**5.55**	**533.33**	**2.07**
Sakha 95	**T1**	**7.95**	**44.01**	**4.32**	**419.33**	**1.81**
	T2	**7.76**	**61.88**	**7.20**	**555.00**	**2.09**
	T3	**7.83**	**59.40**	**6.49**	**506.67**	**2.01**
	T4	**7.90**	**54.34**	**5.50**	**465.00**	**1.94**
Misr 3	**T1**	**8.06**	**53.39**	**4.89**	**416.67**	**1.75**
	T2	**7.83**	**72.38**	**7.29**	**543.33**	**1.98**
	T3	**7.89**	**69.73**	**7.10**	**557.67**	**1.96**
	T4	**7.90**	**56.25**	**5.72**	**460.00**	**1.89**
LSD 0.05		**Ns**	**Ns**	**Ns**	**Ns**	**Ns**

Table 9. Cont.

		2020-2021				
Cultivars		**Soil pH**	**NPK available (mg Kg^{-1})**			**Organic matter (%)**
			N	**P**	**K**	
Gemmeiza 12		7.98	46.78	4.82	405.83	1.88
Sakha 95		8.05	53.79	4.75	441.67	1.80
Misr 3		7.93	51.09	4.91	419.16	1.71
L.S.D. 0.05		1.96	3.56	Ns	17.02	0.1
mineral and organic fertilizer		**Soil pH**	**NPK available (mg Kg^{-1})**			**Organic matter (%)**
			N	**P**	**K**	
T1		8.10	39.53	2.93	338.33	1.56
T2		7.87	59.20	5.66	476.11	1.94
T3		7.95	54.42	5.71	484.44	1.88
T4		8.03	49.06	5.01	390.00	1.80
L.S.D. 0.05		0.053	2.71	0.4	25.1	0.082
Cultivars * Treatments		**Soil pH**	**NPK available (mg Kg^{-1})**			**Organic matter (%)**
			N	**P**	**K**	
Gemmeiza 12	**T1**	8.12	35.02	2.98	341.67	1.67
	T2	7.86	53.80	5.64	438.33	2.01
	T3	7.95	51.28	5.68	431.67	1.96
	T4	8.02	47.00	4.96	411.67	1.86
Sakha 95	**T1**	8.13	43.45	2.56	358.33	1.55
	T2	7.92	62.98	2.72	500.00	1.97
	T3	8.02	56.41	5.64	508.33	1.89
	T4	8.11	52.30	5.07	400.00	1.80
Misr 3	**T1**	8.04	40.12	3.24	315.00	1.46
	T2	7.84	60.82	5.61	490.00	1.84
	T3	7.88	55.55	5.81	513.33	1.80
	T4	7.96	47.88	4.99	358.33	1.74
L.S.D. 0.05		Ns	Ns	Ns	35.59	Ns

T1: 100% of the recommended dose of N (75 kg N $fed^{-1)}$.

T2: 75% of the recommended dose of N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.

T3: 50% of the recommended dose of N (37.50 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.

T4: 25% of the recommended dose of N (18.75 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.

The three wheat cultivars along with 100% of the recommended dose of mineral N (T1) exhibited the highest values of soil pH in both seasons. In contrast, the interaction effects of 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2) with the three wheat cultivars gave the lowest values of soil pH in both seasons. The interaction effects of 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2) with the three wheat cultivars produced the highest values of available N content in both seasons. These results are in line with Ahmed *et al* (2014). The improvement of plant growth and productivity due to organic fertilization could be attributed to the enhancement of soil with organic matter, and therefore, improving soil quality. El-Sheref *et al* (2018) detailed that, compost is much of the time saw as an approach to further improving soil fertility by improving soil physical properties as well as expanding soil organic carbon and nutrient availability. Compost has a high nutritional value, with high concentrations of N, P and K and very extremely low convergences of heavy metals and other harmful substances (EL-Sayed 2012).

NPK uptake of wheat grain and straw (kg fed^{-1})

Data in Tables (10 and 11) showed that, nitrogen uptake was significantly affected by cultivars in the first season for wheat grain and in both seasons for straw. On the other hand, the effects of wheat cultivars on phosphorous uptake were significant for wheat grain only in the first season, whereas, it were insignificant in both seasons for straw. Potassium uptake significantly increase in wheat grain only in the second season and in straw in both seasons by wheat cultivars. Sakha 95 had the highest mean value of NPK uptake in both grain and straw in both seasons. The effects of treatments and the interaction between cultivars and nitrogen combination treatments were insignificant for these traits in both seasons. The greatest values of NPK uptake were recorded by applying 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2). Maximum values of N uptake of wheat grain and straw were recorded by Sakha 95 and Misr 3 with applying 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2).

Table 10. NPK uptake of grains and straw and protein (%) affected by cultivars, nitrogen combination treatment and their interactions after harvest wheat in 2019/2020 growing season.

		NPK uptake of grain			
Cultivars		N	P	K	Protein (%)
		Kg fed^{-1}			
Gemmeiza 12		76.44	11.29	25.34	12.81
Sakha 95		86.15	12.18	27.02	13.21
Misr 3		83.92	14.44	27.57	13.53
L.S.D. 0.05		5.3	2.16	Ns	0.47
mineral and organic fertilizer		N	P	K	Protein (%)
		Kg fed^{-1}			
T1		85.50	11.03	24.33	12.87
T2		85.89	13.89	29.96	13.60
T3		80.63	12.67	27.04	13.56
T4		76.65	12.96	25.24	12.70
LSD 0.05		Ns	Ns	Ns	0.29
Cultivars * Treatments		N	P	K	Protein (%)
		Kg fed^{-1}			
Gemmeiza 12	T1	78.73	9.82	23.05	12.5
	T2	77.98	13.41	28.27	12.96
	T3	78.77	11.65	26.71	13.42
	T4	70.27	10.27	23.31	12.33
Sakha 95	T1	89.52	9.58	24.34	12.9
	T2	90.12	13.1	31.28	13.7
	T3	83.11	11.31	26.73	13.53
	T4	81.85	14.74	25.73	12.68
Misr 3	T1	88.26	13.67	25.61	13.19
	T2	89.57	15.17	30.32	14.1
	T3	80.02	15.03	27.66	13.76
	T4	77.83	13.87	26.67	13.08
LSD 0.05		Ns	Ns	Ns	Ns

Table 10. Cont.

Cultivars		NPK uptake of straw		
		N	P	K
		Kg fed^{-1}		
Gemmeiza 12		80.53	10.51	138.09
Sakha 95		102.30	12.68	170.16
Misr 3		116.29	14.19	188.01
LSD 0.05		10.13	Ns	10.18
mineral and organic fertilizer		N	P	K
		Kg fed^{-1}		
T1		101.27	11.46	168.96
T2		112.80	13.72	180.01
T3		97.68	12.27	156.10
T4		87.08	12.40	156.60
LSD 0.05		Ns	Ns	Ns
Cultivars * Treatments		N	P	K
		Kg fed^{-1}		
Gemmeiza 12	T1	89.27	10.33	152.63
	T2	89.84	11.9	153.08
	T3	73.55	9.54	120.31
	T4	69.46	10.29	126.35
Sakha 95	T1	103.88	12.05	167.32
	T2	111.63	13.03	179.02
	T3	97.26	12.31	162.5
	T4	96.44	13.33	171.79
Misr 3	T1	110.68	12.00	186.93
	T2	136.93	16.22	207.95
	T3	122.23	14.97	185.51
	T4	95.32	13.58	171.66
LSD 0.05		Ns	Ns	Ns

T1: 100% of the recommended dose of N (75 kg N fed$^{-1)}$.
T2: 75% of the recommended dose of N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.
T3: 50% of the recommended dose of N (37.50 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.
T4: 25% of the recommended dose of N (18.75 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.

Table 11. NPK uptake of grains and straw and protein (%) affected by cultivars, nitrogen combination treatments and their interaction after harvest wheat in 2020/2021 growing season.

		NPK uptake of grain			
Cultivars		N	P	K	Protein (%)
		Kg fed^{-1}			
Gemmeiza 12		82.44	15.67	25.00	12.53
Sakha 95		83.21	15.48	27.66	12.90
Misr 3		81.32	15.67	26.40	13.17
L.S.D. 0.05		Ns	Ns	1.13	0.35
mineral and organic fertilizer		N	P	K	Protein (%)
		Kg fed^{-1}			
T1		83.86	14.04	23.63	12.42
T2		87.10	17.67	30.98	13.40
T3		81.29	15.82	27.61	13.24
T4		77.03	14.89	23.20	12.41
LSD 0.05		Ns	Ns	5.03	0.27
Cultivars * Treatments		N	P	K	Protein (%)
		Kg fed^{-1}			
Gemmeiza 12	T1	84.73	13.31	22.38	12.16
	T2	86.46	18.48	29.16	13.08
	T3	80.08	15.84	25.53	12.79
	T4	78.49	15.06	22.91	12.11
Sakha 95	T1	86.57	14.25	25.29	12.45
	T2	88.05	17.12	32.83	13.53
	T3	81.45	15.33	28.39	13.36
	T4	76.75	15.23	24.15	12.28
Misr 3	T1	80.28	14.58	23.22	12.68
	T2	86.8	17.42	30.95	13.59
	T3	82.35	16.29	28.9	13.53
	T4	75.86	14.38	22.53	12.85
LSD 0.05		Ns	Ns	Ns	Ns

Table 11. Cont.

		NPK uptake of straw		
Cultivars		**N**	**P**	**K**
		Kg fed^{-1}		
Gemmeiza 12		**81.63**	**13.50**	**139.11**
Sakha 95		**102.32**	**14.16**	**181.09**
Misr 3		**93.67**	**14.55**	**174.93**
LSD 0.05		**4.57**	**Ns**	**14.78**
mineral and organic fertilizer		**N**	**P**	**K**
		Kg fed^{-1}		
T1		**98.29**	**12.87**	**172.27**
T2		**106.66**	**16.53**	**189.70**
T3		**84.23**	**13.24**	**149.81**
T4		**80.98**	**13.64**	**148.39**
L.S.D. 0.05		**Ns**	**Ns**	**Ns**
Cultivars * Treatments		**N**	**P**	**K**
		Kg fed^{-1}		
Gemmeiza 12	**T1**	**89.21**	**13.05**	**152.54**
	T2	**101.88**	**16.99**	**168.35**
	T3	**71.33**	**11.19**	**120.68**
	T4	**64.1**	**12.28**	**114.86**
Sakha 95	**T1**	**100.13**	**11.87**	**176.25**
	T2	**114.53**	**16.38**	**201.84**
	T3	**98.99**	**14.62**	**175.56**
	T4	**95.62**	**13.77**	**170.7**
Misr 3	**T1**	**105.53**	**13.7**	**188.03**
	T2	**103.58**	**16.21**	**198.91**
	T3	**82.36**	**13.9**	**153.19**
	T4	**83.21**	**14.38**	**159.6**
LSD 0.05		**Ns**	**Ns**	**Ns**

T1: 100% of the recommended dose of N (75 kg N fed$^{-1)}$.

T2: 75% of the recommended dose of N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.

T3: 50% of the recommended dose of N (37.50 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.

T4: 25% of the recommended dose of N (18.75 kg N fed^{-1}) + compost application at 2 ton fed^{-1}.

The greatest values of PK uptake for wheat grain and straw in both seasons were obtained by Misr 3 by applying 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2). These results are in line with those obtained by Abo-Elela *et al* (2015). These expansions in N uptake values in grain and straw yield could be because of compost fertilization that has a high nutritional value, with high concentrations of especially nitrogen and to improving physical and chemical soil properties.

Protein content (%):

Results introduced in Tables (10 and 11) revealed that, the impact of cultivars and treatments were significant increment in protein content % in wheat grain in both seasons, while, the interaction between cultivars and nitrogen combination treatments was insignificant in both seasons. Misr 3 had the best incentive for this trait (13.53 and 13.17) in the 1^{st} and 2^{nd} seasons, respectively .The highest values of protein content was recorded by applying 75% of the recommended dose of mineral N (56.25 kg N fed^{-1}) + compost application at 2 ton fed^{-1} (T2) in the 1^{st} and 2^{nd} seasons (13.60 and 13.40), respectively. The effect of combination of compost and chemical fertilizers on grain protein was positive, because of more nutrients availability.

CONCLUSION

In light of the previously mentioned discussion, it very well may be presumed that applying of mineral nitrogen in combination with compost significantly expanded wheat yield as well as further soil properties, i.e., total porosity (%), hydraulic conductivity (cm/hr), soil available NPK content, organic matter (%), NPK-uptake and protein content (%). On the contrary, bulk density, and soil pH values were diminished.

REFERENCES

A.O.A.C. (1990). Official Methods of the Analysis. Association of Official Agricultural Methods. 15th Edition, Published by Association of Official Analytical Chemists, Arlington, Virginia, USA.

A.O.A.C. (2012). Official Methods of Analysis of AOAC Internation*al* 19th ed. Gaithersburg, MD, USA, Association of Analytical Communities.

Abd Elgalil, M. A. S. and A. M. A. Abdel-Gawad (2020). Irrigation water regime and manure extract for wheat production grown under drip irrigation. Archives of Agriculture Science Journal, 3:306-318.

Abd El-Gawad, A. M. and A. S. M. Morsy (2017). Integrated impact of organic and inorganic fertilizers on growth, yield of maize (Zea mays L.) and soil properties under Upper Egypt conditions. J. Plant Prod. Mansoura Univ., 8:1103–1112.

Abo-Elela, E. G., S. Y. M. Abo-Steet, E. E. E. Khafagy and I. S. M. Mosaad (2015). Influence of mineral and organic nitrogen fertilizers on growth and yield of some wheat varieties and some soil properties North Delta. Fayoum J. Agric. Res. & Dev., 29(1):106-120.

Agegnehu, G., C. van Beek and M. I. Bird (2014). Influence of integrated soil fertility management in wheat and tef productivity and soil chemical properties in the high land tropical environments. J. Soil Sci. Plant Nutr., 14: 532–545.

Ahmed, A. A., A. S. El-Henawy and B. Elsayed (2014). Effect of chemical nitrogen and compost rates on wheat productivity and soil properties. https://www.researchgate.net/publication.

Akram, Z., S. U. Ajmal and M. Munir (2008). Estimation of correlation coefficient among some yield parameters of wheat under rainfed conditions. Pak. J. Bot., 40(4): 1777–1781.

Aksu , T. (2017). The effects of different nitrogen and farm manure doses on yield, quality and antioxidant activity of bread wheat (*Triticum aestivum* L.). M. Sc.Thesis, Adnan Menderes University, Graduate School of Natural and Applied Sciences, Department of FieldCrops.

Al-Sayed, H. M, S. A. Hegab, M. A. Youssef and M. Y. Khalafallah (2019). Integrated effect of organic nitrogen sources on growth and yield of rosselle (*Hibiscus sabdariffa* L.). Assiut Journal of Agricultural Science, 50(3):164-183.

Blake, G. R. and K.H. Hartage (1986). Methods of Soil Analysis: Bulck Density. 2nd ed. ed. Klute A. Madison Wisconsin USA: American society of agronomy Inc. and soil science society of America Inc.: 363-375.

Chen, H., A. Deng, W. Zhang, W. Li, Y. Qiao, T. Yang, C. Zheng, C. Cao and F. Chen (2018). Long-term inorganic plus organic fertilization increase yield and yield stability of winter wheat. Crop J., 6:589-599.

Cottenie, A., M. Verloo, L. Kickens, G. Velghe and R. Camerlynck (1982). Chemical analysis of plants and soils. Laboratory of Analytical and Agrochemistry. State University, Ghent Belgium, 63.

Ding, S., D. Zhou, H. Wei, S .Wu and B. Xie (2021). Alleviating soil degradation caused by watermelon continuous cropping obstacle: application of urban waste compost. Chemosphere, 262:128387.

Economic Affairs Sector (2021). Ministry of Agriculture and Land Reclamation. Egypt, Annual Report.

EL-Sayed, M. M. (2012). Integrating soil moisture with nitrogen management for crop production and environmental protection .Ph.D. Thesis, Fac. Agric., Assiut Univ., Egypt.

El-Sheref, G. F. H., H. A. Awadalla and H. M. Abu El Fotoh (2018). Minimizing of using potassium fertilizer by using foliar spraying and organic manuring and its effect on maize productivity and soil properties. J. Soil Sci. and Agric. Eng. Mansoura Eng. Mansoura Univ., 9(11):615- 625.

El-Sorady, G. A., A. A. A. El-Banna, A. M. Abdelghany, E. A. A. Salama, H. M. Ali, M. H. Siddiqui, N. G. Hayatu, L. S. Paszt and S. F. Lamlom (2022). Response of bread wheat cultivars inoculated with Azotobacter Species under different nitrogen application rates. Sustainability,14, 8394.

FAO, (2020). 'Food and Agricultural Organization of United Nations.' GIEWS Country Brief Egypt**.** https://www.fao.org/giews.

Gomez, K. A. and A. A. Gomez (1984). Statistical procedures for agricultural Research (2nd) John Willey and Sons, New York, 680.

Hignette, T.P. (1999). Trends in technology-Sixth Francis Nw memorial lecture. The International Fertilizer Society, 108: 42-6.

Hühn, M. (1990). On the variability of harvest indices. J. Agron. Crop Sci., 164: 271-281.https://doi.org./10.1111/j.

Iqbal A.1., M. U. Mushtaq, A. H. A. Khan, I. Nawaz, S. Yousaf, and M. Iqbal (2020). Influence of *Pseudomonas japonica* and organic amendments on the growth and metal tolerance of *Celosia argentea* L. Environ. Sci. Pollut. Res. Int., 27(20):24671-24685.

Ismail, M. M. and A. A. Moursy (2018). Organo-mineral fertilization of wheat: Impact on growth andN-recovery using 15N-stable isotope. Bangladesh J. Bot., (47): 815–821.

Jamal, A. and M. Fawad (2018). Application of different organic manures in optimizing optimum yield for wheat in calcareous soil. World News of Natural Sciences, 20: 23-30.

Khan S., T. J. Mohammad, A. Bilal, A. Tariq and A. Wisal (2016). Yield and yield components of maize as affected by integrated management of sheep manure and urea fertilizer. Middle East Journal of Agriculture Research, 5(4):522-533.

Klute, A. (1986a). Water Retention: Laboratory Methods. In: Methods of Soil Analysis, ed. A Klute. Madison, Wisconsin: Am. Soc. Agron., 635–662.

Klute, A. (1986b). Methods of Soil Analysis" Part 1. Physical and Mineralogical Methods. Second edition. Ame. Soc. of Agron.y, (2nd ed), Agron. Monogram. 9, ASA, and SSSA, Madison.906-926.

Levene, H. (1960). Robust tests for equality of variances. In Ingram Olkin, Harold Hotelling, Etalia, Stanford University press. pp. 278-292.

Mohamed, A., E. M. Soliman and U. S. El- Bialy (2021). Effect of foliar spray (algae extract), compost and biofertilizers on wheat productivity. Journal of Environmental science, 50(1):23-49.

Ojha, B. R. (2012). On-farm evaluation of yield and yield attributing traits of promising wheat genotypes at mid-western hills of Nep*al* Journal of Plant Breeding, 7: 3-14.

Page, A.L., R. H. Miller and D. R. Keeney (1982). Methods of Soil Analysis. Part 2. Chemical and Microbiological Properties. American Society of Agronomy. In Soil Science Society of America, 1159: 539-579.

Sheldrick, B.H. and C. Wang (1993). Particle Size distribution. In: Soil Sampling and Methods of Analysis, Ed.: Carter, M.R. Canadian Society of Soil Science, Lewis Publishers, Ann Arbor, MI., 499-511.

Spaccini, R., A. Piccolo, J. S.C. Mbagwa, T. A. Zena and C.A. Igwe (2002). Influence of the addition of organic residues on carbohydrates content and structural stability of some highland soil in Ethiopia. Soil Use and Mgt., 18: 404-411.

Tubeileh, A.M. and G. T. Stephenson (2020). Soil amendment by composted plant wastes reduces the *Verticillium dahlia* abundance and changes soil chemical properties in a bell pepper cropping system. Curr. Plant Biol. ,22:100-148.

Walkley, A.J. and I.A. Black (1934). Estimation of soil organic carbon by the chromic acid titration method. Soil Sci., 37:29-38.

Zemicheal, B. and N. Dechassa (2018). Effect of mineral fertilizer, farmyard manure, and compost on yield of bread wheat and selected soil chemical properties in Enderta District, Tigray Regional State, Northern Ethiopia. East Afr. J. Sci., (12):29-40.

تأثيرالتسميد النيتروجيني المعدني والعضوي علي انتاجية بعض اصناف قمح الخبز وتحسين خواص التربة

شيماء الدسوقى ابراهيم[1]، امنية محمود امين المصيلحى[1] ورشا رفعت الخميسي[2]

١. قسم بحوث القمح – معهد بحوث المحاصيل الحقلية– مركز البحوث الزراعية – مصر.

٢. معهد بحوث الأراضي والمياة والبيئة – مركز البحوث الزراعية – مصر.

أجريت هذه الدراسة بمحطة البحوث الزراعية بالجميزة– مركز البحوث الزراعية – مصر خلال موسمين زراعيين ٢٠١٩/٢٠٢٠ و ٢٠٢٠/٢٠٢١ لدراسة تاثير أضافة السماد المعدني والعضوي والتفاعل بينهما على بعض أصناف قمح الخبز لزيادة الانتاجية وتحسين خواص التربة. وقد استخدم تصميم القطع المنشقة مرة واحدة بتوزيع القطاعات الكاملة العشوائية في ثلاثة مكررات حيث وضعت أصناف قمح الخبز(جميزة ١٢ و سخا ٩٥ و مصر ٣) في القطع الرئيسية، بينما القطع المنشقة فقد إحتوت على ٤ معاملات للتسميد النيتروجيني المعدني والعضوي. أشارت النتائج إلى وجود تأثيرات عالية المعنوية على محصول الحبوب ومساهماته نتيجة لإضافة معاملات للتسميد النيتروجيني المعدني والعضوي سواء في صورة منفردة أو مخلوطة. كما أشارت النتائج إلى تفوق صنف قمح الخبز سخا ٩٥ لمحصول الحبوب. وقد حققت المعاملة ٧٥% من جرعة التسميد النيتروجيني المعدنى الموصى به + ٢ طن كمبوست للفدان أعلى محصول للحبوب والقش في الأصناف الثلاثة. أظهرت نتائج معامل الإرتباط بين الصفات المدروسة إلى وجود إرتباط موجب وعالي المعنوية بين وزن الألف حبة ومحصول الحبوب و القش. كما أشارت النتائج إلى أن إضافة التسميد العضوي مع التسميد النيتروجيني المعدني بمعدل ٥٠ و ٧٥% من الموصى به إلي نقص قيم الكثافة الظاهرية وحموضة التربة وزيادة المسامية الكلية، التوصيل الهيدروليكي، صلاحية عناصر النيتروجين والفوسفور والبوتاسيوم و المادة العضوية بالتربة بعد حصاد القمح. أدي أضافة التسميد العضوي والمعدني بمعدل تسميد معدني (٧٥% من الموصي به) +٢ طن كمبوست/فدان T2 الي اعطاء اعلي امتصاص لكل من عناصر النيتروجين والفسفور والبوتاسيوم من قبل الحبوب والقش لمحصول القمح . وكذلك زيادة محتوى الحبوب من البروتين .

المجلة المصرية لتربية النبات ٢٦(١): ١٢٧- ١٥٥ (٢٠٢٢)