European Journal of Biological Sciences 13 (1): 13-24, 2021
ISSN 2079-2085

DOI: 10.5829/idosi.ejbs.2021.13.24

Impact of Some Soil Amendments Combined with Different Nitrogen Fertilizer Rates on Wheat Productivity Grown in Two Soil Types

Enga M. Niel

Soils, Water and Environment Research Institute, ARC, Egypt

Abstract: Two field experiments were carried out in a newly reclaimed sandy soil under sprinkler irrigation system at El-Ismailia Agricultural Research Station, El Ismailia Governorate, Egypt located between Latitude 30° 35' 30" N, Longitude 32° 14' 50" E. Another experiment was conducted in clayey soil under traditional irrigation system at El-Qanater El-Khairia research station Agricultural Research Station, with wheat (*Triticum aestivum*, cv Giza 5) during the agricultural growing season of 2018 and 2019. Additional target of this work was to study the residual effect of clover plants on wheat plants compared with applying some organic soil amendment (compost and FYM, both at 5 Mg acre^{-1}) combined with different rates of nitrogen (control, 75 and 100 % of the recommended dose) to reduce nitrogen fertilizers application and increase nitrogen use efficiency. The obtained results showed that the application of nitrogen rates at 100 % influenced the growth characteristics, grain yield and quality of wheat plants grown on both soils under study. Also, application of organic amendments (FYM and compost) revealed that application of FYM was more effective treatment. Regard to soil type (sandy and clayey) obtained data showed the application of nitrogen levels and organic amendments on clayey soil was more effective than sandy soil. Regarding the interaction between nitrogen rates and organic amendments the data indicated that nitrogen applied at rate of 75 % of recommended dose with FYM on clayey soil was the most effective treatment for all growth characteristics, grain quality and yield of wheat plants under study. Finally, from the obvious results it could be concluded that application of farmyard manure with 75 % nitrogen of recommended dose improve the soil properties of sandy and clayey soil which increased the productivity of wheat plants grown after clover plants.

Key words: Residual effect · Fertilizer use efficiency · Wheat · Clover · Grain yield productivity · Nitrogen rates · Soil amendments

INTRODUCTION

Wheat (*Triticum aestivum* L.) is amongst the three most important cereals worldwide symbolizing over a quarter of the total world's cereal production and a chief source of calories for more than 1.5 billion people as well around the globe [1]. In Egypt, as of 2020, the wheat production in Egypt amounted to approximately 8.9 million metric tons, which represented an increase of 1.48 percent from the preceding year. During the last decade, the Egyptian wheat production ranged between 7.2 and 8.9 million metric tons in 2010 and 2020 respectively. Throughout the period observed, an overall positive can be noticed with a comprehensive increase of around 23.6 percent during the decade. Wheat is one of the most important crops for Egypt and this can be recognized through Egypt being the one of the largest wheat importers in the world [2].

Increasing the efficiency of wheat (*Triticum aestivum* L.) production is vitally important [3]. Well-established plant stand and proper nutrient management are critical for producing a successful wheat crop [4]. Using appropriate planting rate for hard red wheat is critical to establishing plant stands that ensure optimum yields. This is because plant population directly affects wheat grain yield by influencing the key yield components [5]. Nitrogen rate significantly affected wheat grain yield, protein content, protein yield and N uptake at both locations and N use efficiency at one of two locations.

Wheat grain protein is a key quality characteristic that determines wheat marketability.

Corresponding Author: Enga M. Niel, Soils, Water and Environment Research Institute, ARC, Egypt.

The nitrogen applied is not taken up by the plants or immobilized in the soil, is susceptible to volatilization, denitrification and loss by leaching. Total N-use efficiency in the growing system can be increased by the higher efficiency of N from N inputs, or by reducing the amount of N lost from soil resources [6]. For agricultural systems to remain productive, the supply of nutrients removed or lost from the soil has to be replenished [7]. Nitrogen, inputs to the agricultural system may be partially replaced by the biological fixation of atmospheric N_2 (BFN) provided by leguminous species [8]. The use of leguminous plants in the rotation or mixed crop is, nowadays, regarded as an alternative to the sustainable way of introducing N into the growing systems.

The concept of organic agriculture is receiving increased attention and organic food markets are expanding rapidly in many countries including India [9].

Soil organic matter (SOM), which is arguably the most complex and least understood aspect of soil, determines its physical, chemical and biological properties, as well as its functions in the environment. SOM improves soil fertility, increases crop yields and positively affects food production, water storage, the retention of xenobiotics, the development of soil microorganisms and nutrient cycling [10]. Organic matter decomposition is enhanced in the area immediately around roots (the rhizosphere). Roots release organic compounds, such as carbohydrates, amino acids and vitamins, into the soil, stimulating growth of microorganisms in this zone. Many of these organisms decompose organic matter, resulting in nutrient release to the crop. Very little research has been done to determine which plant varieties or species best support these nutrient-releasing microorganisms. In the future, such information may help identify crop varieties well adapted to organic systems [11].

The aim of this work to study the effect of applying some organic soil amendments (compost and FYM, both at 5 Mg acre^{-1}) under different rate of nitrogen (control, 75 and 100 % of recommended dose) to reduce nitrogen fertilizers application and increase nitrogen use efficiency.

MATERIALS AND METHODS

Two field experiments were carried out in a newly reclaimed sandy soil under sprinkler irrigation system at El Ismailia Agricultural Research Station, El Ismailia Governorate, Egypt located between Latitude 30° 35' 30" N, Longitude 32° 14' 50" E. Another experiment was conducted in clayey soil under traditional irrigation system at El-Qanater El-Khairia research station Agricultural Research Station, located between Latitude 30° 36' 57.63" N, Longitude 32° 14' 38.88" E with wheat (*Treatecum stavium*, cv Giza 5) during the agricultural growing season of 2018 and 2019. The current study to identify the direct beneficial effects of applying some organic soil amendment (compost and FYM, both at 5 Mg acre^{-1}) under different rates of nitrogen (control, 75 and 100 % of recommended dose) on some hydrophysical and fertility status of sandy and clay soils as well as vegetative growth, yield and its attributes of the studied wheat crop. Some hydrophysical, chemical and fertility status of the studied sandy and clay soils are illustrated in Tables (1, 2).

The applied locally soil amendments were represented by organic compost (composted plant residues) and Farmyard Manure (FYM). The applied soil amendments are determined according to the previous standard methods according to [12] and the main physical, chemical and nutrient status of organic compost then they obtained data are illustrated in Table (3). The applied treatments were performed as soil application in fixed plots, with an area of 10.5 m^2 for each plot, which arranged in a split plot design the nitrogen rates as main plots and soil amendments as sub plots, with three replicate for each one.

Some physical, chemical and fertility properties of the investigated soil (bulk density, total porosity, hydraulic conductivity, moisture constants and nutrients retained) at elongation stage of vegetative growth were determined according to the standard methods as described by [12, 13, 14, 15]. Available N, P and K were extracted by 1% K_2SO_4, 0.5 M solution sodium bicarbonate and 1.0N ammonium acetate, respectively and were determined according to [12]. Available micronutrients of Fe, Mn and Zn were extracted by DTPA [16] and determined using Atomic Absorption Spectrophotometer. Yield of wheat and nutrient contents of N, P, K, Fe, Mn and Zn) were determined.

For each plot, the chosen samples of both grains and straw were dried; ground and wet digested using H_2SO_4+$HClO_4$ acid mixture. In the digested plants, N was determined with a micro-Kjeldahl [12]. Phosphorus was determined calorimetrically, according to [14]. Potassium was determined using a Flame photometer, according to [12]. Iron, manganese and zinc were determined using an Atomic Absorption Spectrophotometer. All collected data were statistically analyzed according to [17]. Grain protein content was calculated by multiplying the total N content in the grain by a factor of 5.7 [18].

Table 1: Some physical and chemical properties of the sandy soil

Soil characteristics	Value	Soil characteristics	Value
Particle size distribution %:		*Soluble cations* (soil paste m mole$_c$ L^{-1}):	
Sand	87.25	Ca^{2+}	0.82
Silt	8.90	Mg^{2+}	0.58
Clay	3.85	Na^{+}	0.95
Textural class *Sandy*	K^{+}	0.14	
Soil chemical properties:		*Soluble anions* (soil paste mole$_c$ L^{-1}):	
pH (1.25 soil water suspension)	7.69	CO_3^{2-}	nd
$CaCO_3$ %	1.33	HCO_3^{-}	1.45
Organic carbon %	0.21	Cl^{-}	0.71
ECe (dS/m, soil paste extract)	0.25	SO_4^{2-}	0.34
Soil physical properties:			
Bulk density g cm^{-3}	1.68	Total aggregate %	14.79
Hydrulic conductivity (cm h^{-1})	5.84	Avail. Water %	7.11
Soil moisture at wilting point %	4.98	Soil moisture at field capacity %	12.09

Available nutrients mg kg^{-1}						
N	P	K	Fe	Mn	Zn	Cu
11.79	5.58	70.01	6.42	0.88	0.51	0.02

Table 2: Some physical and chemical properties of the clay soil

Soil characteristics	Value	Soil characteristics	Value
Particle size distribution %:		*Soluble cations* (soil pastem mole$_c$L^{-1}):	
Sand	21.7	Ca^{2+}	14.20
Silt	34.4	Mg^{2+}	2.73
Clay	43.9	Na^{+}	16.50
Textural class *Clayey*	K^{+}	0.75	
Soil chemical properties:		*Soluble anions* (soil paste mole$_c$L^{-1}):	
pH (1.25 soil water suspension)	7.82	CO_3^{2-}	0.00
$CaCO_3$ %	2.86	HCO_3^{-}	3.00
Organic carbon %	2.37	Cl^{-}	18.20
ECe (dS m^{-1}, soil paste extract)	3.40	SO_4^{2-}	12.98
Soil physical properties:			
Bulk density g cm^{-3}	1.15	Total aggregate %	2.08
Hydrulic conductivity (cm h^{-1})	1.72	Avail. Water %	26.11
Soil moisture at wilting point %	7.50	Soil moisture at field capacity %	18.61

Available nutrients mg kg^{-1}						
N	P	K	Fe	Mn	Zn	Cu
48.90	8.65	498.00	7.25	1.83	1.40	1.14

Table 3: Some characteristics of the studied locally organic soil amendments

Organic Compost		Farmyard Manure	
Characteristics	Value	Characteristics	Value
pH (1:10 water suspension)	7.15	pH (1:10 water suspension)	8.04
Weight of 1 m^3 (kg)	497	Weight of 1 m^3 (kg)	358
Moisture content%	35.07	Cellulose %	38.3
EC (dS m^{-1}, 1:10 water extract)	2.34	Lignin %	13.8
CEC m mol$_c$ L^{-1}	28.81	Moisture content%	35.07
Organic matter %	49.44	EC (dS/m, 1:10 water extract)	1.91
Organic carbon %	28.8	CEC (m mol$_c$ L^{-1})	20.11
Total N %	1.63	Organic matter %	49.44
C/N ratio	17.7	Total carbon %	25.9
Total P %	0.42	Total N %	0.75
Total K %	3.07	C/N ratio	20.4
Available nutrients (mg kg^{-1})			
N	354	N	580
P	532	P	675
K	704	K	304
Fe	41.93	Fe	970
Mn	23.8	Mn	5.31
Zn	19.84	Zn	16.04
Cu	1.41	Cu	4.90
B	0.25	B	0.11

The obtained data of both successive seasons were not significantly different; their average was taken into consideration as [19] test was done to the homogeneity of error variance. The test was not significant for all assessed traits, so, the two season's data were combined.

RESULTS AND DISCUSSIONS

The current work may be helpful for identifying the best soil agro-management practices of some newly reclaimed soils for maximizing their productivity, especially for soils have no partially capable to retain neither water nor nutrients for growing plants. In addition, these soils are poor not only in the nutrient-bearing minerals, but also in organic matter, which are a storehouse for the essential plant nutrients; in turn, the productivity of different crops tends to decrease markedly [20].

Effect of Nitrogen Rates and Organic Amendments on Growth Parameters of Wheat Plants: The obtained data in Table 4 showed that the application of different nitrogen rates (0, 75 and 100 % of recommended dose) have a positive effect on plant height and dry matter by increasing nitrogen rate where the application of nitrogen at 100 % of recommended dose for wheat plant. The role of N in increasing plant height as they stimulate the vegetative development due to nitrogen produce rapid early growth and encourages the uptake and utilization of other nutrients including potassium, phosphorous and controls overall growth of plant [21, 22].

The results of application of different sources of organic soil amendments revealed that application of FYM was more effective than compost for all growth parameters under study. This may be due to the availability of nutrients was higher in FYM than compost which enhance plant growth and productivity as mentioned by [23] application of organic fertilizer gave an increase in N, P and K content as compared with untreated one. The combination of compost with chemical fertilizer further enhanced the biomass and grain yield of crops [24].

Regard to soil type data in (Table 4) show that the clay soil in texture gave higher plant height and dry matter mean values compared with sandy soil one this could be due to the sandy soil was poor native fertility status as compared to the productivity of a clayey soil, which is characterized by a heavy texture grade supported with native fertility status as reported by [25].

Results of the interaction between nitrogen rate and organic amendments different soil types showed that application of FYM at 75% of recommended nitrogen rate was more effective treatment for both soil types but the clayey soil in texture at the same treatment was superior to sandy one due to the soil particles in clay texture was more compacted, higher in CEC, nutrients availability. According to [26] who mentioned that organic fertilizers can serve as alternative practice to minimize the use of mineral fertilizers as they aid in improving soil structure, increase soil organic carbon and microbial biomass. Also application of compost or FYM improved the physical and chemical properties of sandy soil that was reflected in wheat growth parameters under study compared with control.

Effect of Nitrogen Rates and Organic Amendments on Yield and Yield Components of Wheat: Data in (Table 5) indicated that the application of nitrogen at 100 % of recommended dose sole was more effective than other rates on yield and yield components this may be due to presence of nitrogen in adequate amount sufficient to enhance the vegetative growth of plants where It is most imperative element for proper growth and development of plants which significantly increases and enhances the yield and its quality by playing a vital role in biochemical and physiological plant [22]. The optimum rate of nitrogen increases photosynthetic processes, leaf area production, leaf area duration as well as net assimilation rate [28].

Furthermore, application of two sources of soil amendments data showed that application of FYM superior to compost as mean values of straw yield were 3.04, 3.69 and 2.37, 2.73 Mg acre^{-1}, 100 grain weight was 49.67, 56.4 and 48.00, 53.33 g and grain yield was 5.22, 6.91 and 4.56, 6.66 Mg acre^{-1} for farmyard manure and compost, respectively. This may be due to FYM is a potential resource as a fertilizer and soil amendment in crop production. The addition of farmyard manure (FYM) is known to change the physical and chemical properties of soils. The addition of organic materials, particularly the composted ones, increased soil physical properties, mainly by improving aggregate stability and decreasing soil bulk density [28].

As for soil types the obtained data in (Table 5) revealed that clayey soil in texture was more favorable for all yield component parameters under study where straw yield 1.75 and 0.53 Mg acre^{-1}, 100 grain weight 50.1 and 40.7 g and grain yield 4.65 and 1.69 Mg acre^{-1} for clayey and sandy soil, respectively. This trend may suggest that

Table 4: Effects of different organic soil amendments and nitrogen rates on some growth parameters of wheat grown on two types of soil

	Type of soil							
	Sandy oil				Clayey soil			
Nitrogen Rate (%)	Control	Compost	FYM	Mean	Control	Compost	FYM	Mean
				Plant height (cm)				
Control	59.50	68.73	72.19	66.81	125.23	129.90	131.25	128.79
75	69.48	85.85	89.38	81.57	138.39	132.87	145.82	139.03
100	71.15	95.08	102.91	89.71	132.17	127.50	129.77	129.81
Mean	66.71	83.22	88.16	79.36	131.93	130.09	135.61	132.54
				Dry matter (Kg)				
Control	75.41	84.56	89.02	82.99	85.10	89.77	91.58	88.82
75	81.03	87.42	94.69	87.71	90.11	92.03	98.25	93.46
100	88.47	91.31	97.82	92.53	89.31	90.25	95.31	91.62
Mean	81.64	87.76	93.84	87.75	88.17	90.68	95.05	91.30

			LSD at 0.05			
Parameters	N	C	C×N	N	C	C×N
Plant height	2.30	4.00	2.75	1.05	0.91	1.20
Dry matter	3.10	2.50	3.01	2.25	1.15	1.85

N= Nitrogen rate and C= Organic amendments

Table 5: Effects of different organic soil amendments and nitrogen rates on yield and yield components of wheat grown on two types of soil.

	Type of soil							
	Sandy soil				Clay soil			
Nitrogen Rate (%)	Control	Compost	FYM	Mean	Control	Compost	FYM	Mean
				Straw yield (Mg $acre^{-1}$)				
Control	0.53	1.78	1.98	1.43	1.75	1.97	2.78	2.17
75	1.70	2.68	4.02	2.80	2.68	3.78	4.53	3.66
100	2.01	2.64	3.12	2.59	2.44	2.45	3.77	2.89
Mean	1.41	2.37	3.04	2.27	2.29	2.73	3.69	2.91
				100 grain weight (g)				
Control	40.70	41.70	43.65	42.02	50.10	54.30	59.70	54.70
75	50.40	56.30	59.40	55.37	53.70	63.00	67.50	61.40
100	53.00	52.65	53.90	53.18	55.70	58.70	61.60	58.67
Mean	48.03	50.22	52.32	50.19	53.17	58.67	62.93	58.28
				Grain yield (Mg $acre^{-1}$)				
Control	1.69	1.80	3.05	2.18	4.65	4.31	5.82	4.93
75	3.38	5.37	5.87	4.87	7.71	9.53	8.07	8.44
100	5.85	6.50	6.75	6.37	5.54	6.14	6.84	6.17
Mean	3.64	4.56	5.22	4.47	5.97	6.66	6.91	6.51

			LSD at 0.05			
Parameters	N	C	C×N	N	C	C×N
Straw yield	0.25	0.70	1.00	0.50	0.35	1.10
100 grain weight	2.20	1.50	2.00	1.55	1.04	1.11
Grain yield	0.92	0.43	0.22	0.52	0.31	0.34

N= Nitrogen rate, C= Organic amendments and Acre ≈ Fedan

the studied sandy soil was poor native fertility status as compared to the productivity of a clayey soil, which is characterized by a heavy texture grade supported with native fertility status.

Finally, data in (Table 5) showed the interaction effect of nitrogen at 75% of recommended dose with FYM applied in clayey soil was the superior treatment for yield and yield components under study followed by compost at the same treatment as mentioned by [29] who stated that FYM applications significantly increased total N, available P and exchangeable K contents of the soil. FYM application was the major source of variation for all elements. Also, the interaction effect between organic manure and nitrogen fertilizers increased the nitrogen uptake in grain [30].

Effect of Nitrogen Rates and Organic Amendments on Straw NPK Contents of Wheat Plants: Date in (Table 6) indicated that the application of inorganic nitrogen source at different rates (0, 75 and 100 % of recommended dose) have a different response on straw NPK content in both type of soil as in sandy soil nitrogen content 0.46, 0.65, 0.73 %, phosphorous content 0.35, 0.39, 0.42 % and potassium content 0.37, 0.45, 0.51 % and for clayey soil nitrogen content 1.23, 1.30, 1.53 %, phosphorous content 0.41, 0.45, 0.48 % and potassium content 0.57, 0.65, 0.73 % for zero, 75 and 100 % of recommended nitrogen dose, respectively. Nitrogen a fundamental role in enhancing the productivity of four major crops like, wheat, rice, sugarcane and cotton.

Wheat growth and yield parameters, plant height, number of tillers and 1000-grain weight increased by nitrogen fertilization [31].

Regard to organic amendments (compost and FYM) the mean value of straw NPK content revealed that the application of FYM was more responsive than compost where nitrogen content 1.41 and 1.99 %, phosphorous content 0.53 and 0.57% and potassium content 0.65 and 0.86 % this may be due to the application of FYM increases in total N, available P, exchangeable K and organic carbon contents of the soil [29] and sole application of farm yard manure (FYM) resulted in increased yield of maize [32]. Moreover, application of organic fertilizers decrease soil pH, reduced bulk density might be due to increased soil bio pores and soil aeration, higher soil organic carbon content and better soil aggregation that ultimately improved soil porosity and water holding capacity [33].

As mentioned before the highest value of straw NPK content was observed in clay soil as showed in Table 6 where the nutrient content in clay soil higher than in sandy soil which characterized by its high water drainage and low nutrient contents.

Also, the integrated effect of applying FYM combined with inorganic nitrogen source at 75 % of recommended dose was the superior treatment even if wheat plants grown in clayey or sandy soil. The interaction effect between organic manure rates and nitrogen fertilizers levels on grain yield of corn plant have the highest values [30]. Furthermore, Increased N bioavailability was recorded after the application of composted manure to plants and increased nutrients availability from soil was associated with the improvement of soil properties [34].

Effect of Nitrogen Rates and Organic Amendments on Grain NPK Contents of Wheat: Table, 7 revealed that the application of different nitrogen rates (0, 75 and 100 % of recommended dose) have a positive response by increasing nitrogen rate on nitrogen content, phosphorous content and potassium content of grain as mentioned previously the sufficient amount of nitrogen in soil encourages the uptake and utilization of other nutrients including potassium, phosphorous and controls overall growth of plant encourages the uptake and utilization of other nutrients including potassium, phosphorous and controls overall growth of plant [35].

Nitrogen being a major element for plants is an essential constituent of protein (build from amino acids that involves in catalization of chemical responses and transportation of electrons) and chlorophyll (enable the process of p hotosynthesis) present in many major portions of the plant body. Nitrogen plays a most important role in various physiological processes. It imparts dark-green color in plants, promotes leaves, stem and other vegetative part's growth and development. Moreover, it also stimulates root growth. Nitrogen produces rapid early growth, improves fruit quality, enhances the growth of leafy vegetables and increases protein content of fodder crops [36].

Application of organic amendments (compost and FYM) showed a different response where farmyard manure the more effective one for grain NPK content application of FYM was more responsive than compost where nitrogen content 2.76 and 3.51 %, phosphorous content 0.43 and 0.52 % and potassium content 1.32 and 1.43 % this may be due to the application of FYM increases in total N, available P, exchangeable K and organic carbon content of the soil [29] and sole application of farmyard manure resulted in increased yield of maize [32]. The uptake of NPK by plant was significantly affected by application of organic manure rates and nitrogen fertilizers levels [30].

Data in (Table 7) show that the clayey soil in texture gave higher plant height and dry matter mean values compared with sandy soil one this could be due to the sandy soil was poor native fertility status as compared to the productivity of a clayey soil, which is characterized by a heavy texture grade supported with native fertility status as reported by [25].

Table 6: Effects of different organic soil amendments and nitrogen rates on straw NPK content of wheat grown on two types of soil

	Type of soil							
	Sandy soil				Clay soil			
Nitrogen Rate (%)	Control	Compost	FYM	Mean	Control	Compost	FYM	Mean
				Nitrogen content (%)				
Control	0.46	1.06	1.31	0.94	1.23	1.53	1.72	1.49
75	0.65	1.32	1.50	1.16	1.30	1.81	2.28	1.80
100	0.73	1.25	1.43	1.14	1.53	1.72	1.98	1.74
Mean	0.61	1.21	1.41	1.08	1.35	1.69	1.99	1.68
				Phosphorous content (%)				
Control	0.35	0.42	0.49	0.42	0.41	0.46	0.49	0.45
75	0.39	0.48	0.57	0.48	0.45	0.52	0.63	0.53
100	0.42	0.45	0.54	0.47	0.48	0.50	0.59	0.52
Mean	0.39	0.45	0.53	0.46	0.45	0.49	0.57	0.50
				Potassium content (%)				
Control	0.37	0.49	0.55	0.47	0.57	0.69	0.78	0.68
75	0.45	0.67	0.76	0.63	0.65	0.81	0.97	0.81
100	0.51	0.58	0.63	0.57	0.73	0.78	0.82	0.78
Mean	0.44	0.58	0.65	0.56	0.65	0.76	0.86	0.76

	LSD at 0.05					
Parameters	N	C	C×N	N	C	C×N
Nitrogen	0.11	0.50	0.05	0.05	0.15	0.20
Phosphorous	0.05	0.10	0.02	0.01	0.05	0.01
Potassium	0.01	0.10	0.01	0.02	0.10	0.05

N= Nitrogen rate and C= Organic amendments

Table 7: Effects of different organic soil amendments and nitrogen rates on grain NPK content of wheat grown on two types of soil

	Type of soil							
	Sandy soil				Clayey soil			
Nitrogen Rate (%)	Control	Compost	FYM	Mean	Control	Compost	FYM	Mean
				Nitrogen content (%)				
Control	1.68	2.20	2.55	2.14	2.35	2.61	3.16	2.71
75	1.89	2.75	2.92	2.52	2.80	3.27	3.83	3.3
100	2.17	2.59	2.80	2.52	2.95	3.15	3.53	3.21
Mean	1.91	2.51	2.76	2.39	2.70	3.01	3.51	3.07
				Phosphorous content (%)				
Control	0.34	0.36	0.40	0.37	0.38	0.42	0.49	0.43
75	0.39	0.41	0.46	0.42	0.43	0.48	0.56	0.49
100	0.37	0.39	0.42	0.39	0.40	0.44	0.52	0.45
Mean	0.37	0.39	0.43	0.39	0.40	0.45	0.52	0.46
				Potassium content (%)				
Control	0.62	0.94	1.23	0.93	0.87	1.13	1.28	1.09
75	0.85	1.18	1.44	1.16	1.22	1.35	1.62	1.40
100	0.91	1.05	1.30	1.09	1.29	1.21	1.40	1.30
Mean	0.79	1.06	1.32	1.06	1.13	1.23	1.43	1.26

	LSD at 0.05					
Parameters	N	C	C×N	N	C	C×N
Nitrogen	0.11	0.22	0.41	0.23	0.12	0.07
Phosphorous	0.07	0.03	0.11	0.07	0.09	0.05
Potassium.	0.09	0.33	0.12	0.04	0.06	0.05

N= Nitrogen rate and C= Organic amendments

Finally, data in (Table 7) showed the interaction effect of nitrogen at 75% of recommended dose with FYM applied in clay soil was the superior treatment for yield and yield components under study followed by compost at the same treatment as mentioned by [37] who stated that FYM applications significantly increased total N, available P and exchangeable K contents of the soil. FYM application was the major source of variation for all nutrients. Also, [30] reported that the interaction effect between organic manure and elemental nitrogen fertilizers levels increased the nitrogen uptake in grain.

Effect of Nitrogen Rates and Organic Amendments on Quality of Wheat Grain Grown on Two Types of Soil: The obtained results in (Table 8) show a positive response for grain quality parameters of wheat plants to applied nitrogen at 100 % of recommended dose compared to other rates (zero and 75 %) as mentioned before the application of nitrogen in adequate amount increasing plant growth, quality and productivity this may be due to nitrogen increase the availability of other nutrients as phosphorous and potassium as increasing levels of nitrogen significantly influence on grain yield of crop [21]. Also, the sufficient amount of nitrogen in soil encourages the uptake and utilization of other nutrients including potassium, phosphorous and controls overall growth of plant encourages the uptake and utilization of other nutrients including potassium, phosphorous and controls overall growth of plant [35]. Farmyard manures are the major source of nutrient supply also on small farm holdings [38].

Application of two sources of organic amendments (FYM and compost) data revealed that application of FYM was more effective one where grain crude protein 17.23, 23.58 g 100 g^{-1} DW, total carbohydrates 67.53, 73.23 g 100 g^{-1} DW and starch content 47.23, 57.57 g 100 g^{-1} DW for two types of soil under study as the implication of organic manures (OM) in crop production not only improves soil physiochemical properties but also increases crop productivity and is eco-friendly, cheap, readily available and a potential source of nutrients [39]. Eventually, the application of organic matter improved the plant root development, final grain yields and chemical fertilizer use efficiency in the maize-based cropping system. The higher levels of soil nutrients and the physical properties observed during the late crop growth period under organic manures application suggest that the benefits of organic manures application could be long term [40].

Regarding soil type data in Table, 8 the clay soil in texture gave higher plant height and dry matter mean values compared with sandy soil one this could be due to the sandy soil was poor native fertility status as compared to the productivity of a clayey soil, which is characterized by a heavy texture grade supported with native fertility status as reported by [25].

Yet, the integrated effect of applied nitrogen rates (0, 75 and 100 %) of recommended dose combined with organic amendments revealed that addition of nitrogen at 75 % of recommended dose with FYM was the most responded treatment. Proper growth and development of plants require optimum supply of nitrogen. Too little application of nitrogen directly reduces crop yield while excess of N also causes negative effects on plant and this issue getting focus continuously in crop production [22].

Effect of Nitrogen Rates and Organic Amendments on Soil Nutritional Status after Harvest of Wheat Plants Grown on Two Types of Soil: In concern with soil nutritional status data in (Table 9) indicated that application of nitrogen at different rate (0, 75 and 100 %) of recommended dose improved the nitrogen, phosphorus and potassium content by increasing the applied nitrogen rate as mentioned by [41] the early application of N further increased available N in the soil above what the plant would be able to absorb in the initial stages. Also, the positive interactive of nitrogen with other nutrients like phosphorous, potassium and sulphur was mentioned by [23].

Data of available N, P and K in soil as affected by the applied composted plant residues as compared with N-mineral fertilizer at different growth stages of wheat plants grown on the studied two soil types are presented in (Table 9). Organic manures application improved the water retention capacity of the soil (*i.e.*, increased soil permeability, saturation and total available and readily available water contents), also indicated that organic matter could hold and sustain more soil moisture levels under natural conditions [40]. However, long-term residual impacts of slowly and rapidly decomposing organic amendments may differ significantly over time. Moreover, it is likely that the effects of organic manures may differ in different soil types depending on the soil moisture status and the plant available water contents under different precipitation frequencies and intensities.

Table 8: Effects of different organic soil amendments and nitrogen rates on quality of wheat grain grown on two types of soil

	Type of soil							
	Sandy soil				Clay soil			
Nitrogen Rate (%)	Control	Compost	FYM	Mean	Control	Compost	FYM	Mean
				Crude protein (g 100g^{-1} DW*)				
Control	10.50	13.75	15.94	13.40	14.69	16.31	19.75	16.92
75	11.81	17.19	18.25	15.75	17.50	20.44	28.94	22.29
100	13.56	16.20	17.50	15.75	18.44	19.69	22.06	20.06
Mean	11.96	15.71	17.23	14.97	16.88	18.81	23.58	19.76
				Total carbohydrates (g 100g^{-1} DW*)				
Control	60.1	63.9	65.5	63.17	66.70	68.30	69.40	68.13
75	63.5	67.6	69.8	66.97	69.10	71.60	77.10	72.60
100	64.8	65.8	67.3	65.97	70.80	72.40	73.20	72.13
Mean	62.8	65.77	67.53	65.37	68.87	70.77	73.23	70.96
				Starch content (g 100g^{-1} DW*)				
Control	40.70	43.90	45.90	43.50	50.60	54.20	55.80	53.53
75	42.80	46.40	48.7	45.97	53.50	56.60	59.50	56.53
100	44.50	45.70	47.1	45.77	55.80	55.10	57.40	56.10
Mean	42.67	45.33	47.23	45.08	53.30	55.30	57.57	55.39

LSD at 0.05						
Parameters	N	C	C×N	N	C	C×N
Crude protein	1.00	1.1	0.05	0.90	0.32	0.44
T. carbohydrate	1.43	0.65	0.12	1.23	0.54	0.65
Starch content	1.05	0.21	0.11	092	0.23	0.34

N= Nitrogen rate, C= Organic amendments and DW= dry weight

Table 9: Effects of different organic soil amendments and nitrogen rates on soil nutritional status after harvest of wheat plants grown on two types of soil

	Type of soil							
	Sandy soil				Clayey soil			
Nitrogen Rate (%)	Control	Compost	FYM	Mean	Control	Compost	FYM	Mean
				Nitrogen content (mg kg^{-1})				
Control	29.76	31.50	35.90	32.39	34.85	46.38	50.06	43.76
75	37.66	49.00	57.85	48.17	40.90	58.82	65.76	55.16
100	42.48	45.10	52.70	46.76	45.45	56.70	61.25	54.47
Mean	36.63	41.87	48.82	42.44	40.40	53.97	59.02	51.13
				Phosphorous content (mg kg^{-1})				
Control	10.38	13.60	14.98	12.99	12.50	16.74	19.30	16.18
75	11.65	16.45	18.74	15.61	14.16	18.55	24.75	19.15
100	12.70	14.80	15.62	14.37	15.33	17.81	22.39	18.51
Mean	11.58	14.95	16.45	14.32	13.99	17.70	22.15	17.95
				Potassium content (mg kg^{-1})				
Control	95.60	114.49	127.90	112.66	175.80	198.57	208.40	194.26
75	107.25	128.55	153.85	129.88	188.12	229.60	265.62	227.78
100	110.79	120.75	146.55	126.03	195.60	214.75	245.81	218.72
Mean	104.55	121.26	142.77	122.86	186.51	214.31	239.94	213.59

LSD at 0.05						
Parameters	N	C	C×N	N	C	C×N
Nitrogen content	2.22	0.91	1.72	1.54	2.21	2.43
Phosphorous content	3.12	1.11	2.33	1.33	1.43	3.55
Potassium content	2.54	143	1.32	5.23	2.05	3.03

The aforementioned results showed that the amounts of available N, P and K differed according to the soil type, plant physiological stage and their contents in the applied organic composts, which are more related to the source of composted materials.

The obtained results showed pronounced differences between the available contents of N, P and K in the studied soil types of sandy and clayey texture grades. In general, sandy soil contains available N, P and K fractions less than clayey one at all different growth stages of wheat plants. This could be easily related to the initial status of these nutrients in both the studied soil types, as shown in Table (1 and 2), which more related to the occurrence of the nutrient are bearing minerals.

With regard to applied composted plant residues and N-mineral fertilizer, results again revealed a trend of the control < N-mineral fertilizer < N- mineral fertilizer + Compost < N- mineral fertilizer + FYM treatment as an ascending order for the available N content in both the studied soil types at the different stages of growth stages. Combination with organic amendments also helps, especially in preventing return of the compactions integrated use of organic manures can ensure an ecologically sound technology for improving physiochemical and hydrological properties of soil and crop productivity. Therefore, either type of organic manure can be applied by farmers to minimize the risks of soil degradation and fertility depletion to gain higher crop productivity and agricultural sustainability. With added organic manures, the soil bulk density decreased and the porosity increased [33].

CONCLUSION

The above mentioned presentation and discussion could be concluded that there were no similarity for both studied soil types (*i.e.*, clayey and sandy) as for as their responses for the concerned grain quality parameters, *i.e.,* total protein and carbohydrate contents, which showed the best values with FYM accompanied with75% N-mineral fertilizer grown after clover plants.

REFERENCES

1. Anonymous, 2015. ICAR-IIWBR. Vision 2050. Karnal: ICAR-Indian Institute of Wheat and Barley Research, pp: 48.
2. Elbeltagi, A., M.R. Aslam, A. Malik, B. Mehdinejadiani, A. Srivastava, A.S. Bhatia and J. Deng, 2020. The impact of climate changes on the water footprint of wheat and maize production in the Nile Delta, Egypt. Science of the Total Environment, 743: 140770.
3. Bekkerman, A., K.B. Fuller and M. Del Curto, 2019. Montana Wheat and Barley Survey Results Summary. Montana Wheat and Barley Planted Varieties: A Visual Overview for 2019. Collage of Agriculture and MAES.
4. West Bred, 2015. Soil and nutrient management for wheat. West Bred Agronomic Spotlight. Monsanto Technology, LLC.
5. Manitoba Government, 2019. Aiming for higher wheat yields. Retrieved from https://www.gov.mb.ca/agriculture/crops/production/aiming-for-higher-wheat-yields.html.
6. Cassman, K.G., A. Dobermann and D.T. Walters, 2002. Agroecosystems, nitrogen-use efficiency and nitrogen management. AMBIO: A Journal of the Human Environment, 31(2): 132-140.
7. Peoples, M.B., D.F. Herridge and J.K. Ladha, 1995. Biological nitrogen fixation: an efficient source of nitrogen for sustainable agricultural production? In Management of biological nitrogen fixation for the development of more productive and sustainable agricultural systems (pp: 3-28). Springer, Dordrecht.
8. Sullivan, B.W., W.K. Smith, A.R. Townsend, M.K. Nasto, S.C. Reed, R.L. Chazdon and C.C. Cleveland, 2014. Spatially robust estimates of biological nitrogen (N) fixation imply substantial human alteration of the tropical N cycle. Proceedings of the National Academy of Sciences, 111(22): 8101-8106.
9. Willer, H. and M. Yussefi, 2006. The World of Organic Agriculture. Statistics and Emerging Trends. International Federation of Organic Agriculture Movements (IFOAM), Bonn Germany & Research Institute of Organic Agriculture FiBL, Frick, Switzerland. ISBN-10: 3-906081-81-8; ISBN-13: 978-3-906081-81-6.
10. Weil, R. and F. Magdoff, 2004. Significance of soil organic matter to soil quality and health. In Soil Organic Matter in Sustainable Agriculture; Magdo, F., Weil, R., Eds.; CRC Press: Boca Raton, FL, USA, pp: 1-36. ISBN 0-8493-1294-9.
11. Rangarajan, A., C.L. Mohler and S.E. Johnson, 2009. Crop rotation effects on soil fertility and plant nutrition.Crop Rotation on Organic Farms. University of Maryland: NRAES.
12. Jackson, M.L., 1973. Methods of chemical analysis. New Delhi: Prentice Hall of India.

13. Piper, C.S., 1950. Soil and Plant Analysis. Int. Sci., Publishers; Inc., New York, USA.
14. Richards, L.A., 1954. Diagnosis and Improvement of saline and alkali soils. Agric. Handbook No. 60. USD Agric., Washington, USA.
15. Page, A.L., R.H. Miller and D.R. Keeney, 1982. Methods of Soil Analysis. Part 2: Chemical and Microbiological Properties. Second edition. Agronomy J. 9: 2, Am. Soc. Agron. Inc., Soil Sci. Soc. Am. Inc. Pub. Madison, Wisconsin, USA.
16. Lindsay, W.L. and WA. Norvell, 1978. Development of a DTPA soil test for zinc, iron, manganese and copper. Soil Science Society of America Journal, 42: 421-428
17. Watanabe, F.S. and S.R. Olsen, 1965. Test of an ascorbic acid method for determining phosphorus in water and $NaHCO_3$ extracts from soil. Soil Science Society of America Journal, 29(6): 677-678.
18. Rosentrater, K.A. and A.D. Evers, 2017. Introduction to cereals and pseudocereals and their production. In: Kent's Technology of Cereals, pp: 1-76. DOI: 10.1016/B978-0-08-100529-3.00001-3.
19. Bartlett, M.S., 1937. Properties of sufficiency and statistical tests. Royal Society. Vol. 106 issue 901. https://doi.org/10.1098/rspa.1937.0109 https://royalsocietypublishing.org/ DOI:https://doi.org/10.1098/rspa.1937.0109.
20. Moustafa, M.A.A., N.R. Habashy and A.A.W. Anas, 2005. Utilization of some organic polymers and humic acids for improving a sandy soil productivity of peanut and their residual effects on the next crop of faba bean. Fayoum J. Agric. Res. and Dev., 9(2): 42-55.
21. Amjed, A., A. Ahmad, W.H. Syed, T. Khaliq, M. Asif, M. Aziz and M. Mubeen, 2011. Effects of nitrogen on growth and yield components of wheat. (Report). Sci. Int. (Lahore), 23(4): 331-332.
22. Leghari, S.J., N.A. Wahocho, G.M. Laghari, L.A. Hafeez, B.G. Mustafa, T.K. Hussain, T.A. Bhutto, S.A. Wahocho and A.A. Lashari, 2016. Role of nitrogen for plant growth and development: A Review. Advances in Environmental Biology, 10(9): 209-219.
23. Socolow, R.H., 1999. Nitrogen management and the future of food: lessons from the management of energy and carbon. Proc. Natl. Acad. Sci. U.S.A., 96: 6001-6008.
24. Abedi, T., A. Alemzadeh and S.A. Kazemeini, 2010. Effect of organic and inorganic fertilizers on grain yield and protein banding pattern of wheat. Australian Journal of Crop Science, 4(6): 384-389.
25. Nader R. Habashy, Laila K.M. Ali and M.H. Abd El-Salam 2009. A comparison study on effect of organic and mineral fertilizers on some wheat characteristics grown on the Nile alluvial and desert sandy soils. Fayoum J. Agric. Res. & Dev., 23(1): 112-126.
26. Ng'etich, O.K., J.N. Aguyoh and J.O. Ogweno, 2012. Effects of composted farmyard manure on growth and yield of spider plant (*Cleomegy nandra*). International Journal of Science and Nature, 3(3): 514-520.
27. Ahmad, S., R. Ahmad, M.Y. Ashraf, M. Ashraf and E.A. Waraich, 2009. Sunflower (*Helianthus annuus* L.) response to drought stress at germination and seedling growth stages. Pak. J. Botany, 41(2): 647-654.
28. Diacono, M. and F. Montemurro, 2015. Effectiveness of organic wastes as fertilizers and amendments in salt-affected soils. Agriculture, 5(2): 221-230.
29. Bayu, W., N.F.G. Rethman, P.S. Hammes and G. Alemu, 2006. Application of farmyard manure improved the chemical and physical properties of the soil in a semi-arid area in Ethiopia. Biological agriculture & horticulture, 24(3): 293-300.
30. Shawer, S.S. and I.M. Abdalla, 2019. Effect of organic and nano nitrogen fertilization on soil properties, crop production and nutrients uptake by corn plant in sandy soil. J. Biol. Chem. Environ. Sci., 14(1): 247-262.
31. Rafiq, M.A., A. Ali, M.A. Malik and M. Hussain, 2010. Effect of fertilizer levels and plant densities on yield and protein contents of autumn planted maize. Pak. J. Agri. Science, 47: 201-208.
32. Anatoliy G.K. and K.D. Thelen, 2007. Effect of winter wheat crop residue on no-till corn growth and development. Agron. J., 99: 549-555.
33. Mahmood, F., I. Khan, U. Ashraf, T. Shahzad, S. Hussain, M. Shahid, M. Abid and S. Ullah, 2017. Effects of organic and inorganic manures on maize and their residual impact on soil physico-chemical properties. Journal of Soil Science and Plant Nutrition, 17(1): 22-32.
34. Malhi, S.S., 2012. Relative effectiveness of various amendments in improving yield and nutrient uptake under organic crop production. J. Soil Sci., 2: 299-311.
35. Bloom, A.J., 2015. The increasing importance of distinguishing among plant nitrogen sources. Current Opinion in Plant Biology, 25: 10-16.

36. Hemerly, A., 2016. Genetic controls of biomass increase in sugarcane by association with beneficial nitrogen-fixing bacteria, In Plant and Animal Genome XXIV Conference. Plant and Animal Genome, During Month of January.
37. Sharif, M., T. Burni, F. Wahid, F. Khan, S. Khan, A. Khan and A. Shah, 2013. Effect of rock phosphate composted with organic materials on yield and phosphorus uptake of wheat and mung bean crops. Pak. J. Bot., 45(4): 1349-1356.
38. Fageria, N., 2012. The Role of Soil Organic Matter in Maintaining Sustainability of Cropping Systems. Communications in Soil Science and Plant Analysis - Commun Soil Sci Plant Anal., pp: 43. 10.1080/00103624.2012.697234.
39. Gangwar, K., K. Singh, S. Sharma and O. Tomar, 2006. Alternative tillage and crop residue management in wheat after rice in sandy loam soils of Indo-Gangetic plains. Soil and Tillage Res., 88: 242-252.
40. Abid, M., T. Batool, G. Siddique, S. Ali, R. Binyamin, M.J. Shahid, M. Rizwan, A.A. Alsahli and M.N. Alyemeni, 2020. Integrated Nutrient Management Enhances Soil Quality and Crop Productivity in Maize-Based Cropping System. Sustainability, 12(23): 10214.
41. Nascente, A.S., M.D.C.S. Carvalho, L.C. Melo and P.H. Rosa, P.H. 2017. Nitrogen management effects on soil mineral nitrogen, plant nutrition and yield of super early cycle common bean genotypes. Acta Scientiarum. Agronomy, 39(3): 369-378.