Enhance Soil Quality and Increasing Yield of Wheat Crop Followed by Maize Crop Grown on Calcareous Soils

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Abstract: A field experiment was conducted in two successive years 2009/2010 and 2010/2011 at the farm of Nubaria Agriculture Research Station (Calcareous soil). Two seasons in each year were carried out during winter 2009 /2011 and summer 2010 and winter 2010/2011 and summer 2011 season. To study the effect and residual effect of farmyard manure (FM) application under two different sources of nitrogen mineral fertilizers on some soil hydro-physical properties and wheat and maize yields and yield components.. Also, to assess and compare of farm profitability of all tested variables. The obtained results revealed that the addition of FYMat rates of 0, 30, 40 m^3/Fed^{-1} compared with mineral nitrogen fertilizer sources [ammonium nitrate (AN) and ammonium sulfate (AS)] at levels of zero, 75% and 100% of the recommended dose has a positive effect on hydro-physical properties. Whereas the highest level of (FYM 40 m^3.$Fed^{-1)}$ reduced the unconfined compressive strength (USC) by about 33% for 2009/2010 and 43.9% in 2010 /2011 compared to the control. The mean values for Hydraulic conductivity ($K_h$cmhr^{-1}) and Infiltration rate (IRcmhr^{-1}) for the highest rate of FYM (40m^3.Fed^{-1}) were arranged in ascending order K_h = (3.87 cm $h^{-1}$and 4.01 cm h^{-1}) and I.R (8.18 cmh^{-1}and8.27 cmh^{-1}) for AN and AS in 2009 / 2010 respectively. While, in season 2010/ 2011 at the highest rate of FYM (40m3. Fed^{-1}) was arranged as Kh= 4.19 cm h^{-1} and 4.44 cm h^{-1}, while for I.R = 8.42 cm h^{-1} and 8.4 cm h^{-1} for AN and AS respectively. The total porosity increased by increasing the rate of FYM while at the highest rate of FYM (40 m3. Fed^{-1}) the mean value of E% increased by about 9% than the control in the first season 2009/2010 and increased by about 9.8% in the second season (residual effect) for both different sources of mineral nitrogen fertilizers over the control. As well as, the mean value of soil available water (W.A) at the highest rate of FYM was increased by about 45% in the first and second season 2009/2010 and 2010/2011 over the control. On the other hand, the dose 75% of mineral nitrogen fertilizers ascertain an improvement for the first winter season on wheat plants for each of the following 1000 seed weight, grain yield and RIY%. Where, the 1000 seed weight increased by 29% and 33% than the control but in the second year, the mean values of 1000 seed weight percentage decreased at a level 75% by 3% and 2% for AN and AS than the first season. While the mean values of grain yield increased by150% and 185.5% for AN and AS respectively over the control. As well as, the mean values of the relative increasing in yield% (RIY%) for grain which obtained at level 75% for both AN and AS were increased by about 34.78 and 32.84 respectively over the control. Similarly, for the dose 75% in corn yield for summer season, the mean values of 100-seed weight (g) for the highest rate of FYM (40 m3. Fed^{-1}) increased at level 75 by about 38.13 and 38.19g for AN and AS, respectively than the control. The mean values of relative increasing yield %RIY could be arranged in the ascending order 26.99%-28.11% at level 75% for Am and AS levels respectively. While the RIY %was increased at a level 75%by2. 13% and 4.59% than the first season for both ANand AS respectively. Comparison between the data in first and second season for corn yield in two summer seasons, there is no significant effect on the mean values of 100 seed weighs, seed yield and RIY%.

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1. Introduction

Calcareous soils which are defined as having the presence of significant quantities of free excess lime ($CaCO_3$) are common in arid and semi-arid region, these types of soils are also having poor in mineral and organic colloids and subsequently they are low fertility i.e., suffer shortage in both macro- and micronutrients beside of their low water retention, also having a hard crust on the surface of soil formation of calcium carbonate and these soils having alkaline reaction. Soil organic matter (SOM) is often considered as a key index of soil quality as it determines numerous factors influencing crop productivity, such as the retention capacity of plant available water (Hydraulic conductivity, Infiltration rate, total porosity, aggregate formation and stabilization , bulk density and cation exchange capacity), (Judith Nyiraneza et al., 2009). Azza et al. (2011) Reported, that organic matter makes its greatest contribution to soil productivity. It provides nutrients to the soil, improves its water holding capacity, and helps the soil to maintain good tilth and thereby better aeration for germinating seeds and plant root development. Intensive cropping systems combining intensive soil tillage and removal of crop residues often lead to decreased levels of SOM and, thereby, to the deterioration of soil quality. Intensive agriculture has had negative effects on the soil environment over the past decades (e. g. Loss of soil organic matter, soil erosion, water pollution) (Zhao et al., 2009). Management methods that decrease requirements for agricultural chemicals are needed in order to avoid adverse environmental impacts (Bilalis et al., 2009). Abdel- Aziz et al (1996) reported that applied soil conditioners namely farmyard manure to calcareous soil resulted in enhancement of soil physical properties, decreasing soil pH and increasing sunflower yield. The use of manure and mulching are two of the basic cultivation techniques of Organic Agriculture (Efthimiadou et al., 2009). Moreover, emerging evidence indicates that integrated soil fertility management involving the judicious use of combinations of organic and inorganic resources is a feasible approach to overcome soil fertility constraints (Abedi et al., 2010; Kazemeini et al., 2010; Mugwe et al., 2009). Combined with organic/inorganic fertilization both enhanced C storage in soils, and reduced emissions from N fertilizer use, while contributing to high crop productivity in agriculture (Pan et al., 2009). Tiwari et al., (2002) have also reported that the inclusion of manure in the fertilization schedule improved the organic carbon status and available N, P, K and S in soil, sustaining soil health. Addition of organic materials of various origins to soil has been one of the most common practices to improve soil physical properties (Celik et al., 2004). Combined use of NPK and farmyard manure increased soil organic matter, total N, Olsen P and ammonium acetate exchangeable K by 47%, 31%, 13% and 73%, respectively compared to application of NPK through inorganic fertilizers (Bhattacharyya et al., 2008). In addition, Zhao et. al. (2009) reported that farmyard manure combined with chemical fertilizer management resulted in a higher increase in maize yield, soil organic matter, available N and available P.

The main objective of this study was to evaluate the effect of inorganic combined with organic fertilization on soil properties, growth and yield components of Wheat followed by maize. We also intended to evaluate soil physical properties on calcareous soil by using organic-inorganic fertilization treatments. Finally, to assess and compare of farm profitability of all tested variables.

2. Materials and Methods:

A field experiments were conducted in two successive years [winter season 2009/2010 with wheat, summer season 2010with maize, winter season 2010/ 2011with wheat and summer season with 2011 with maize] at the farm of Nubaria Agriculture Research Station (Calcareous soil), To study the effect of farmyard manure (FYM) application under two sources of nitrogen mineral fertilizers on some soil physical properties and wheat and maize yield and yield components. Also, the residual effect of FYM was considered in this study.

Experimental design and treatment application:

The design of this experiment was split-spsub lite plot with three replications. The main plot was for farmyard manure rates, the sub – plots were the sources of nitrogen mineral fertilizer and the sub – sub plots were the rate of mineral nitrogen fertilizer. Three rates of farmyard manure (zero, 30, $40m^3fed^{-1}$) were carried out. Two different Nitrogen mineral fertilizers (Ammonium nitrate 33.5% N and Ammonium Sulfate 20.0% N) at the rates zero, 75%, and 100% of the recommended doses of nitrogen fertilizer for each crop under calcareous soil condition were applied. All the interaction between the different treatments were carried out and homogeneously mixed with the topsoil to approximate 30 cm depth before cultivation for each plot.

Winter field experiment:

Seeds of wheat, (Giza 168 varieties) were planted at the rate of 60 Kg fed^{-1} during the second week of November 2009 and 2010. The plot area was $16.8m^2$ (2.8m in width and 6m in length). Nitrogen mineral fertilizer was added in two sources (Ammonium nitrate 33.5%N and Ammonium Sulfate 20.0% N) at the rate of zero, 75%, 100% of recommended doses of nitrogen fertilizer ($100KgNfed^{-1}$), phosphorus fertilizer in the form of mono- superphosphate (15.5%P_2O_5) at the rate 45Kg P_2O_5 fed^{-1} and Potassium fertilizer was added in the form of potassium sulfate (48% K_2O) at the rate of 24Kg K_20 fed^{-1}. Three rates of farmyard manure zero, 30 and $40m^3$were mixed well with the surface layer of the soil 30 cm in winter season only for each year.

Summer field experiment:

In two summer seasons 2010 and 2011which applied maize followed the winter crop to study the residual effects of farmyard manure application in winter season. The same experimental plot was left without any application of farmyard manure .Each plot consisted of 4 rows (6 m long and 0.70 m apart). Seeds of maize (single cross 10 maize hybrid) were planted at the rate of 12 Kg fed^{-1} during the first week of June 2010 and 2011. Each plot received the recommended dose of mineral fertilizer P_2O_5 (45 Kg $P_2O_5fed^{-1}$) and K_2O ($24KgK_2Ofed^{-1}$). Nitrogen mineral fertilizer was added in the two sources (Ammonium nitrate 33.5%N and Ammonium Sulfate 20.0% N) at the rates of zero, 75%, 100% of the recommended doses of nitrogen fertilizer ($120KgNfed^{-1}$).

Sampling procedure:

Composite surface soil samples (0-30cm) were collected before treatment application for soil physical and chemical analyses (Table 1 and 2).

Table (1): Some physical analysis of the investigated soil for two experimental years 2009/ 2010 and 2010/ 2011

Experimental year	Soil depth cm	Mechanical analysis			Soil texture	UCS ton Ft^{-2}	Kh Cm h^{-1}	IR Cm h^{-1}	E(%)	A.W (%)
		Sand %	Silt %	Clay %						
2009/2010	0-30	55.19	23.11	21.70	S.L	4.3	1.89	5.17	46.52	25.13
2010/2011	0-30	55.94	21.93	22.13	S.L	4.2	1.94	5.20	46.19	25.71

UCS: Unconfined compressive strength (ton Ft^{-1}). K_h: Hydraulic conductivity $cmhr^{-1}$. IR: Infiltration rate $cmhr^{-1}$. E: Total porosity (%). A.W: Available water (%). S.L: Sandy loam.

Table (2): Some chemical analysis of investigated soil for two experimental years 2009/ 2010 and 2010 / 2011

Experimental year	Soil depth	Soil pH(1:2.5)	EC (ds/m)	Available macronutrients (ppm)			Total N%	OM %	$CaCO_3$ %
				N	P	K			
2009/2010	0-30	8.24	2.23	39.7	2.52	75.3	0.12	0.32	22.71
2010/2011	0-30	8.22	2.17	37.3	2.71	77.2	0.10	0.27	23.11

Also, of farmyard manure was air dried, ground in a ceramic mortor and passed through 2 mm sieve and stored for chemical analyses (Table3).

Table (3): Some chemical analysis of farmyard manure for two experimental years 2009/ 2010 and 2010 / 2011

Experimental year	pH 1:10	E.C ds^1m	O.M %	Total N %	Total P%	Total K%	Available P%	C/N ratio	Θw %
2009/2010	7.53	2.94	23.11	0.42	0.65	0.52	82.31	12	19.4
2010/2011	7.60	2.79	22.94	0.40	0.71	0.57	79.56	14	18.6

Soil samples at a depth of 0-30 cm were collected at harvesting time in each session for determination of soil hydro physical analysis. Undisturbed soil samples were taken using soil Cores for surface layers (0-30) to determine soil bulk density and hydraulic conductivity (Klute, 1965). Soil resistance to deformation forces, infiltration rate and total soil porosity were determined according to methods described by black et al (1965). Available soil moisture was determined on mass basis pressure extractor apparatus. Total yield (grain and straw) for wheat and seed for maize for each plot were weighed and related to ton fed^{-1}, also 1000 wheat seed and 100-corn seed weight were determined for each treatment. The collected data were statistically analyzed according to procedures outlined by Snedecor and Cochran (1981). Evaluation of the farm profitability of all tested variability was considered.

3. Results and Discussion:

1- Effect of FYM and mineral nitrogen sources on some soil hydro- physical properties:

The improvement of hydro physical properties has been detected by measurements of penetration resistance (Unconfined compressive strength UCS ton Ft^{-1}), Hydraulic conductivity (K_h), available water (A.W), Infiltration rate $cmhr^{-1}$ (I.R) and total porosity (E %).

1-1-Soil penetration resistance (Unconfined compressive strength):

The tested soil is characterized by high $CaCO_3$ content. Under wetting and drying conditions become hardness layer. The data in table (4) revealed that the addition of FYM at the highest rate (40 m^3. Fed^{-1}), was lead to reduce the USC by about 33%for 2009/2010 and 43.9% for 2010 /2011 compared to the control. At the same time, there is no significant effect among the rates and the source of mineral nitrogen fertilizer. This result may be due to the organic manure application which caused a prior reduction in soil resistance. As the products of organic material decomposition during growth season these material enhanced soil aggregation process, subsequently penetrability resistance decreases (El- Fayoumy., et al 2001).

1-2-Soil hydraulic conductivity and Infiltration rate:

The results in Table (4) revealed that application of FYM at different rates caused a gradual significant increase in hydraulic conductivity and Infiltration rate. FYM addition up to the highest rate (40 m3. Fed^{-1}) increased Kh and I.R by about 86% and 60% over the control for 2009 / 2010 season while in the second season (the residual effect) for both hydraulic conductivity and Infiltration rate increased by about 104% and 46% over control respectively. On the other hand, the mean values for Kh and I.R for the highest rate of FYM (40m3 Fed^{-1}) combined with the two sources of mineral nitrogen fertilizers arranged in ascending order Kh 3.87 cm $h^{-1}$and 4.01 cm h^{-1} and I.R8.18cmh^{-1}and8.27 cmh^{-1} for ammonium nitrate and ammonium sulphate in 2009 / 2010, respectively.

Table (4): Effect of mineral Nitrogen sources and farmyard manure on some soil hydro-physical properties in the surface layer (average two experimental years 2009/2010 and 2010/2011).

Treatments			Average two winter seasons 2009/2010 and 2010/2011					Average two summer season 2010 and 2011				
N Source	N rate	FYM rate m^3fed^{-1}	USC Ton ft^{-1}	Kh cm hr^{-1}	IR $cmhr^{-1}$	E%	AW%	USC Ton ft^{-1}	Kh cm hr^{-1}	IR $cmhr^{-1}$	E%	AW%
Ammonium Nitrate 33.5%	Zero	zero	4.2^{d}	1.96^{e}	5.13^{i}	46.41^{c}	25.91^{g}	4.1^{d}	2.03^{e}	5.51^{l}	46.50^{c}	25.80^{c}
		30	3.4^{b}	2.83^{d}	7.09b	47.70^{b}	31.72^{d}	3.0^{bc}	3.11^{d}	7.43^{f}	48.83^{b}	32.20^{bc}
		40	2.8^{a}	3.62^{bc}	8.14^{b}	50.20^{a}	37.80^{a}	2.3^{a}	4.07^{abc}	8.36^{b}	51.70^{a}	37.20^{bc}
	Mean		3.47^{B}	2.80^{c}	6.79^{D}	48.1^{D}	31.81^{c}	3.13^{c}	3.07^{c}	7.10^{D}	49.01^{AB}	31.97^{C}
	75%	zero	4.1^{d}	1.98^{e}	5.3^{gh}	46.45^{c}	26.11^{G}	4.0^{d}	2.12^{c}	7.70^{e}	46.50c	26.20^{e}
		30	3.5^{b}	3.26^{c}	7.2^{de}	47.9^{b}	31.70^{d}	3.3^{c}	3.82^{c}	8.39^{ab}	48.85^{b}	31.85^{c}
		40	2.8^{a}	3.9^{abc}	8.18^{b}	50.51^{a}	37.75^{a}	2.4^{a}	4.22^{ab}	7.24^{Bc}	50.60^{a}	37.90^{a}
	Mean		3.47^{B}	3.15^{B}	6.92^{Bc}	48.3^{BC}	31.85^{BC}	3.23^{D}	3.39^{B}	5.72^{hi}	48.65^{C}	32.15^{AB}
	100%	zero	4.1^{d}	2.05^{e}	5.38^{gh}	46.25^{C}	26.20^{ef}	4.1^{d}	2.20^{e}	46.55^{c}	46.55^{c}	26.25^{e}
		30	3.6^{c}	3.64^{bc}	7.40^{C}	48.21^{b}	31.81^{cd}	$3.2b^{c}$	3.90^{bc}	7.95^{c}	48.71^{b}	31.89^{c}
		40	2.7^{a}	4.11^{a}	8.21^{ab}	50.30^{a}	37.80^{a}	2.5^{a}	4.28^{a}	8.45^{a}	50.41^{a}	37.90^{a}
	Mean		3.47^{B}	3.27^{AB}	6.99^{AB}	48.23^{cD}	31.94^{AB}	3.27^{D}	3.46^{AB}	7.37^{AB}	48.56^{C}	32.01^{C}
Ammonium sulphate 20%	Zero	zero	4.3^{e}	1.87^{e}	5.20^{i}	46.31^{c}	25.88^{g}	4.1^{d}	1.98^{e}	5.67^{ik}	46.62^{C}	26.70^{d}
		30	3.3^{b}	2.89^{d}	7.13^{ef}	48.11^{b}	31.80^{cd}	2.9^{b}	3.31^{d}	7.32^{g}	48.82^{b}	31.98^{bc}
		40	2.8^{a}	3.78^{abc}	8.23^{ab}	50.70^{a}	37.9^{a}	2.2^{a}	4.15^{abc}	8.38^{ab}	51.80^{a}	37.90^{a}
	Mean		3.47^{B}	2.80^{c}	6.79^{D}	48.1^{D}	31.81^{c}	3.13^{c}	3.07^{c}	7.10^{D}	49.01^{AB}	31.97^{C}
	75%	zero	4.0^{d}	1.97^{e}	5.42^{gh}	46.40^{C}	26.20^{ef}	3.9^{d}	2.05e	5.7^{h}	46.80^{c}	26.40^{de}
		30	3.5^{b}	3.72^{bc}	7.27^{d}	48.30^{b}	32.10^{b}	3.0^{bc}	3.98abc	7.85^{d}	48.75^{b}	32.30^{b}
		40	2.7^{a}	4.07^{ab}	8.28^{a}	50.75^{a}	37.80^{a}	2.4^{a}	4.24^{a}	8.40^{ab}	51.35^{a}	37.90^{A}
	Mean		3.40^{A}	3.25^{AB}	6.99^{AB}	48.48^{AB}	32.03^{A}	3.10^{BC}	3.42^{AB}	7.33^{AB}	48.97^{B}	32.20^{A}
	100%	zero	4.0^{D}	1.98e	5.48^{g}	46.50^{C}	26.25e	3.8^{d}	2.31^{e}	5.81^{h}	47.10^{C}	26.30^{e}
		30	3.3^{b}	3.85abc	7.43^{C}	48.35^{b}	31.85^{C}	2.9^{b}	4.12^{abc}	7.98^{C}	48.85^{b}	31.95^{C}
		40	2.6^{a}	4.20a	8.30^{a}	50.80^{a}	37.85^{a}	2.4^{a}	4.32^{a}	8.46^{a}	51.45^{a}	38.0^{a}
	Mean		3.3^{A}	3.34A	7.07^{A}	48.55^{A}	31.98^{A}	3.03^{A}	3.59^{A}	7.42^{A}	49.13^{A}	32.08^{BC}
L.S.D at 0.05			0.2570	0.4952	0.1072	0.9611	0.1820	0.3172	0.3340	0.0974	1.4120	0.3351
L.S.D at 0.05 (mean)			0.1106	0.1872	0.1276	0.1870	0.1051	0.0514	0.1911	0.1592	0.1370	0.1121

Mean value having the same letter (small or capital) are not significantly different based on L.S.D 0.05. As well as, for the residual effect in season 2010/ 2011 for the highest rate of FYM (40m3.Fed^{-1}) combined with the two sources mineral nitrogen fertilizers (ammonium nitrate and ammonium sulphate) was arranged as follows K_h= 4.19 cm h^{-1} and 4.44 cm h^{-1} while for I.R 8.42 cm h^{-1} and 8.4 cm h^{-1}, respectively. It can also be noticed that the mean value of soil K_h and R.I for FYM rates combined with ammonium nitrate and ammonium sulphate were increased by 54.4 % and 61% K_h and by31.1% and 29.7% for I.R in 2009 /2010 as well as, increased by 57% and 60% K_h while by 29% and 27% I.R in 2010 / over the control. Generally, in these increasing in K_h and I.R may be due to modification in pore size distribution.

1-3 Soil total porosity:

Data in Table (4) showed that the total porosity increased by increasing rates especially at the highest rate of FYM (40 m^3 Fed^{-1}) where the mean value about 9% than the control treatment in the first season 2009/2010 while increased by about 9.8% in the second season (residual effect). On the other hand, the mean values of total porosity for different sources and levels of mineral nitrogen fertilizers (ammonium nitrate and ammonium Sulphate increased about 3.9% and 4.2% in the 2009/2010 season and 4.7% and 4.9% in 2010 /2011 season for ammonium nitrate and ammonium Sulphate respectively over the control treatment. This result indicates that there is no variation between two different mineral nitrogen sources on the total porosity in the same season. Also the gradual increases of FYM rates get good variations in soil porosity, especially at the highest rates (40 m^3 Fed^{-1}) of FYM as well as in the second season. In general, improvement of soil total porosity requires the addition of higher rates of organic manure for long periods.

1-4 Available Water:

Data in Table (4) revealed that the available water increased by increasing the rates of FYM adds up to the highest rate (40 m^3. Fed^{-1}). The mean value of soil available water at the highest rate of FYM was increased by about 45% in the first and second season over the control. While it did not significantly increased noticed with the application of different sources of mineral nitrogen fertilizer and their levels. Therefore, the mean values of available water for each source and increased by 22.5% and 22.3% on the first season and 22.8% and 21%at the second season over the control respectively.

2-Effect of FYM and mineral Nitrogen sources of wheat and corn yield and yield components in 2009/2010.

2-1 *Wheat and corn yields and yield component:*

2-1-1 Wheat in winter season 2009/2010

Table (5) shows the significant and positive effect of all treatments and with their levels and rates on the wheat yield and its components. The mean values for 1000 grain weight and yield component, as well as on relative increasing in yield (RIY%) of the wheat plant of two sources of mineral nitrogen fertilizer application associated with FYM ascertained a significantly increased with increasing the levels and rates of FYM in winter season 2009/2010. Considering the highest rate of FYM (40 m^3 Fed^{-1}) the following values of 1000 grain weight of wheat arranged in ascending order at zero level of ammonium nitrate (AN) 49.75g, at 75% (AN) 65.40g and at 100% (AN) 65.89g. On the Other hand, for ammonium Sulphate (AS) at zero level (AS) was 49.15g, at 75% (AS) and 66.21g at 100% (AS) 68.52g. But these data showed that the difference values at a level 75% and 100% for both AN and AS was not significant. Also, it can be noticed that the mean values of 1000 seed weight for ammonium nitrate and ammonium sulphate increased at level 75% and 100% by about 29%, 41%, 33% and 43% respectively over the control. Therefore, wheat grain yield as Ton fed^{-1} was affected by levels of mineral nitrogen fertilizers (ammonium nitrate and ammonium sulphate). As the mean values of wheat grain yield Ton fed^{-1} at the 75% level and the 100% level was almost increased by 150%, 190, 188.5% and 189.3% for ammonium nitrate and ammonium Sulphate respectively over the control. From these results we can be noticed that the difference between the second level (75%) for both mineral nitrogen fertilizers due to the so_4^{--} radical which may lead the mineral nitrogen fertilizers more efficiency in the calcareous soil. Also, for the highest level 100% of both mineral nitrogen fertilizers there is no significant difference. As well as, this result can be noticed between the level (75%) and 100%for ammonium sulphate. Generally, results may suggest the highest increment level 75% of ammonium sulphate. On the other hand, the mean values of the relative increasing in yield% (RIY%) for grain which obtained at level 75% for both AN and AS were increased by about 34.78 % and 32.84 % respectively over the control.

Table (5): Effect of mineral Nitrogen sources and farmyard manure on wheat (winter season2009 /2010) and corn (summer season 2010) yield and yields components).

Treatments			Winter season 2009/2010					Summer season 2010		
N Sources	N level	FYMrate m^{3}/fed^{-1}	1000-seed weight (g)	Yield (Ton fed^{-1})		RIY %		100-seed weight (g)	Seed yield Ton/fed^{-1}	RIY%
				Grain	Straw	Grain	Straw			
Ammonium nitrate 33.5%	Zero	Zero	43.21^{h}	0.750^{k}	0.980^{g}	-	-	23.52^{g}	0.510^{g}	-
		30	46.90^{g}	0.825^{h}	1.050^{g}	10.01	7.14	26.41^{f}	0.800^{f}	56.86
		40	49.75^{ef}	0.990^{g}	1.300^{f}	32.00	32.65	27.25^{ef}	0.885^{f}	73.53
	Mea		46.62^{C}	0.855^{C}	1.110^{D}	14.00	13.27	25.73^{D}	0.732^{D}	43.53
	75%	Zero	49.80^{ef}	1.590^{f}	2.750^{e}	-	-	33.87^{D}	2.575^{e}	-
		30	65.90^{bcd}	2.425^{bc}	4.595^{b}	52.52	67.09	37.65^{C}	3.580^{c}	39.03
		40	65.40^{d}	2.415^{cd}	4.510^{b}	51.89	64.00	38.13^{bc}	3.655^{bc}	41.94
	Mean		60.37^{e}	2.143^{B}	3.950^{C}	34.78	43.64	36.55c	3.270^{C}	26.99
	100%	Zero	64.50^{d}	2.365^{d}	4.110^{d}	-	-	38.19^{b}	3.375^{d}	-
		30	67.11^{abc}	2.505^{a}	4.905^{a}	5.92	19.34	38.74^{abc}	3.685^{bc}	9.19
		40	65.90^{bcd}	2.485^{ab}	4.879^{a}	5.07	18.71	38.97^{abc}	3.805^{ab}	12.74
	Mean		65.89^{A}	2.485^{ab}	4.631^{AB}	3.68	12.68	38.63^{AB}	3.622^{A}	7.47
Ammonuim sulphate 20%	Zero	Zero	43.55^{h}	0.765^{iR}	0.995^{g}	-	-	22.63^{g}	0.495^{g}	-
		30	45.95^{g}	0.810^{hi}	$0.1.002^{g}$	5.88	0.704	27.13^{ef}	0.790^{f}	59.60
		40	49.15^{f}	0.985^{g}	1.280^{f}	28.75	28.64	27.95^{e}	0.895^{f}	80.80
	Mean		46.22C	0.853^{C}	1.092^{D}	11.50	9.75	25.90^{D}	0.727^{D}	46.86
	75%	Zero	50.57^{e}	1.675e	2.910^{e}	-	-	34.71^{d}	2.590^{e}	-
		30	67.55^{ab}	2.510^{a}	4.910^{a}	49.85	68.73	37.89^{bc}	3.610^{c}	39.38
		40	66.21^{bcd}	2.490^{a}	4.865^{a}	48.66	67.18	38.19^{b}	3.695^{abc}	42.66
	Mean		61.50^{B}	2.225^{AB}	$4.22g^{BC}$	32.84	45.29	36.93^{BC}	3.318^{B}	28.11
	100%	Zaro	64.80^{d}	2.390^{ed}	4.300^{c}	-	-	38.25^{abc}	3.38^{d}	-
		30	65.74^{cd}	2.480^{ab}	4.820^{a}	3.77	12.09	39.11^{a}	3.695^{abc}	9.32
		40	68.52^{a}	2.535^{a}	4.985^{a}	6.07	15.93	39.65^{a}	3.850^{a}	13.91
	mean		66.35^{A}	2.468^{A}	4.702^{A}	3.26	9.35	39.00^{a}	3.642^{A}	7.75
L.S.D 0.05			1.5110	0.0566	0.1725	-	-	1.8120	0.1597	-
L.S.D 0.05 mean			1.1451	0.2593	0.4110	-	-	1.4451	0.0235	-

2-1-2 Corn yield in summer season 2010:

The results in Table (5) show considerable increases for 100-seed weight (g), grain yield (Ton fed^{-1}) and RIY (%) for corn yield with increments the levels of mineral nitrogen fertilizers and in the same time increasing the rates of FYM in the summer season 2010. The mean values of 100-seed weight (g) for the highest rates of FYM (40 m^3 Fed^{-1}) at zero level was 27.25, at 75%38.13and at 100%38.97 for ammonium nitrate compared to ammonium Sulphate which was at zero level 27.95g, at 75% 38.19g, at 100% 39.65g respectively. These results indicated that there is no significant variation between the mean values of 100-seed weight (g) at levels 75% and 100% for both mineral nitrogen fertilizers. Also the mean values of 100-seed weight (g) was increased by about 42.5 %at level (75%) and 50% at level (100%) for ammonium nitrate and they increased by about 42.5at level (75%) and50. 5% at level (100%) for ammonium Sulphate over the control. These results indicated that there is no significant effect between the level 75% or 100% for ammonium nitrate and ammonium sulphate, respectively. The mean values of relative increasing yield %RIY could be arranged in ascending order at level zero 43.35%-46.87%, at a level 75% 26.99%-28.11%, at a level 100% 7.47%-7.75% for ammonium nitrate and ammonium Sulphate levels respectively. This result indicates that there is no significant effect between two different sources of mineral nitrogen fertilizers in the summer season also for each level alone.

2-2 Effect of FYM mineral Nitrogen sources of wheat (winter season2010 /2011) and corn (summer season 2011) yield and yield components.

2-2-1 Wheat in winter season2010 /2011:

The results in Table (6) showed the comparison between the first winter season and second winter season for all treatments with their levels and rates on the wheat yield and its components. The mean values of 1000 grain weight increased by applying the treatments in the first and second seasons but this increase was more obvious in the first season. Where, 1000 seed weight percentage decreased in the second season for ammonium nitrate fertilizer level (zero) by 9%, at (75%) 3% and a 100% by6% than the first season. While, for ammonium sulphate fertilizer, it decreased at level zero by 3% at 75% by 2% and 100% by 6% than the first season. These results are in accordance with those obtained by Efthimiadou et al., (2009). On the contrary, the mean values of the relative increasing in yield% g (RIY%) for grain yield which obtained at level 75% for both AN and AS were increased by about 36.91% and 37.43 respectively over the control. While the RIY %was increased at a level 75% by2. 13% and 4.59% than the first season for both ammonium nitrate and ammonium Sulphate respectively. This result shows that the highest increment was obtained from second level 75% of N for both mineral nitrogen fertilizers (ammonium nitrate and ammonium Sulphate) in two seasons 2009/2010 and 2010 /2011.

2-2-2Corn yield in summer season 2010:

Table (6) shows that yield was not significant with the application of FYM and sources of mineral nitrogen fertilizers. Comparison between the data presented in Table (6) and Table (5) there is no significant effect on the mean values of 100 seed weighs, seed yield and RIY

For corn plant in two summer seasons. Efthimiadou et al., 2009 reported that maize crop is more stable under the double rate of cow manure and combined organic and inorganic fertilization treatment compared with inorganic fertilization. Bhattacharyya et. al. (2008) have also reported that a soybean-wheat system was more stable under farmyard manure-treated treatment compared with other fertilizer practices.

3-Profitability assessment:

The data in table (7) show profitability calculations for the input values for different treatments under study, considering the appraisal of all costs and gains of the cultivation process.

Total input costs, outputs, net income and investment ratio (I.R) for all tested treatment were presented in table (8).

The obtained results and their discussion will be handled as follows:

Wheat Crop:

Data presented in table (8) show that the highest net income was obtained when the FYM was applied at a rate of 30 m3 /fed combined with mineral N at the level of 75% from recommended doses for both two sources. The representing net income was 4624.2L.E and 4423.1 L.E that for A.N and AS, respectively. While the representable value for I.R in the same summer was 2.18 and 2.23, respectively. Also results revealed that the lowest values of the same parameters were always related to the absence of N- mineral fertilizer with or without farmyard manure application.

Maize crop:

Data presented in Table (8) showed that, similar to wheat, the highest net income was obtained when the FYM was applied at a rate of 30 m3 /fed combined with mineral N at the level of 75% from recommended doses for both two sources. The representing net income was 601.5L.E and 658L.E for A.N and A.S respectively while the representing I R in the same manner was 1.179 and 1.196, respectively. Also results revealed that the lowest values of the same parameters were always related to the absence of N- fertilizer with or without farmyard manure application.

It was obvious from the previous data that the application of mineral nitrogen fertilizer at a rate more than 75% from recommended dose combined with application of farmyard manure at a rate more than 30m^3 fed^{-1}become higher costs and lower the return and increased investment ratio (I.R).

Table (6) Effect of mineral Nitrogen sources and farmyard manure on wheat (winter season2010 /2011 and corn (summer season 2011) yield and yield components).

Treatments			Winter season 2010/2011					Summer season 2011		
N Sources	N rates	FYM rates m$^{3/}$fed^{-1}	1000-seed weight (g)	Yield (Ton Fed^{-1}) Grain	Straw	RIY (%) Grain	Straw	100-seed weight (g)	Seed yield (Ton/fed^{-1})	RIY(%)
Ammonium nitrate (33.5%)	zero	Zero	48.38^{hi}	0.912^{hi}	1.240^{R}	-	-	23.14^{h}	0.490^{g}	-
		30	48.93^{g}	0.965^{h}	1.410^{i}	5.81	13.71	27.72^{g}	0.805ef	64.29
		40	51.29^{f}	1.195^{h}	1.750^{h}	31.03	41.13	28.11^{g}	0.890^{ef}	81.63
	Mea		49.53^{C}	1.024^{C}	1.466^{C}	12.28	18.23	26.32^{B}	0.728^{C}	48.57
	75%	Zero	56.81^{e}	1.810f	3.230^{g}	-	-	32.97^{f}	2.660^{d}	-
		30	68.91^{b}	2.790^{d}	5.680^{b}	54.14	75.85	37.98^{d}	3.610^{b}	35.71
		40	69.39^{b}	2.835^{bcd}	5.760^{a}	56.63	78.33	38.36^{bc}	3.685^{ab}	38.53
	Mean		65.04^{B}	2.480^{B}	4.890^{B}	36.91	51.39	36.44^{B}	3.318^{B}	24.74
	100%	Zero	65.43^{d}	2.515^{e}	5.060^{f}	-	-	38.20^{bcd}	3.390^{C}	-
		30	69.35^{b}	2.810^{cd}	5.600^{c}	11.73	10.67	38.69^{ab}	3.690^{ab}	8.85
		40	69.41^{b}	2.830^{cd}	5.510^{d}	12.52	8.89	38.81^{a}	3.795^{aa}	11.95
	Mean		68.06^{A}	2.718^{AB}	5.390^{AB}	8.07	6.52	38.57^{A}	3.625^{A}	6.93
Ammonium sulphate (20%)	Zero	Zero	47.17^{i}	0.875^{i}	1.180^{K}	-	-	23.76^{h}	0.512^{g}	-
		30	48.79^{gh}	0.960^{h}	1.430^{i}	9.71	21.19	27.30^{g}	0.785^{f}	53.32
		40	51.47^{f}	1.210^{g}	1.780^{h}	38.29	50.85	28.21^{g}	0.910^{e}	77.73
	Mean		49.14^{C}	1.015^{C}	1.463^{C}	16.00	23.98	26.42^{B}	0.731^{c}	43.75
	75%	Zero	57.35^{e}	2.515^{e}	3.250^{g}	-	-	35.11^{e}	2.680^{d}	-
		30	70.81^{a}	2.810^{cd}	5.750^{ab}	54.01	71.92	38.76^{a}	3.690^{ab}	37.69
		40	71.22^{a}	2.830^{cd}	5.800^{a}	58.55	78.46	38.80^{a}	3.760^{a}	40.30
	Mean		66.46^{AB}	2.718^{AB}	4.930^{AB}	37.43	51.69	37.56^{A}	3.377^{B}	26.01
	100%	Zaro	66.13^{c}	2.580^{e}	5.230^{e}	-	-	38.11^{cd}	3.400^{C}	-
		30	71.04^{a}	2.910^{ab}	5.790^{a}	12.79	9.87	38.74^{a}	3.730^{ab}	9.71
		40	71.22	2.960^{a}	5.820^{a}	14.73	10.44	38.99^{a}	3.810^{a}	12.06
	Mean		69.49^{A}	2.817^{A}	5.627^{A}	9.19	6.77	$38,61^{A}$	3.697^{A}	7.26
L.S.D 0.05			0.5421	0.0792	0.0711	-	-	0.3774	0.1248	-
L.S.D 0.05 mean			1.5210	0.2731	0.6989	-	-	1.0642	0.0246	-

Table (7): Input production items and output of the experimental work coverage two experimental years (2009 and 2010).

Items	Treatments Wheat	Maize	Treatment unite	Unite Price (L.E)
Inputs:				
Mineral fertilizers				
Ammonium nitrate				
75%	75	90	KgNfed^{-1}	8.95
100%	100	120	KgNfed^{-1}	8.95
Ammonium Sulphate				
75%	75	90	KgNfed^{-1}	9
100%	100	120	KgNfed^{-1}	9
P-fertilizer	45	45	KgP_2O_5fed^{-1}	3
K-fertilizer	48	24	KgK_2Ofed^{-1}	12
Farmyard manure				
30	-	-	M^{3}fed^{-1}	42
40	-	-	M^{3}fed^{-1}	42
Seeds				
Wheat	60		Kgfed^{-1}	5.35
maize		12	Kgfed^{-1}	8.50
Land preparation*				
Wheat			Per fedan	140

maize			Per fedan	180
Labour				
Wheat			Per fedan	755
maize			Per fedan	675
Pesticides				
Wheat			Per fedan	130
maize			Per fedan	180
Other costs**				
Wheat				320
Maize				285
Outputs				
Wheat grain yield			Ton	2130
Wheat straw yield			Ton	480
Maize seed yield			Ton	1100

*Rent of agricultural machines
** Depreciation rate of pumping machine,….et, electric consumption, irrigation and drainage systems conservation, tax transportation of seeds, fertilizers, …..etc.

Table (8): Economical assessment of the tested variables (mineral fertilizers and farmyard manure) for the two experimental years (2009 and 2010/2011).

Treatments			Winter seasons (2009/2010) and (2010/2011)								Summer seasons 2010/2011				
N sources	N level	FYM rate m^3 fed^{-1}	Average yield Ton fed^{-1}		Outputs L.E fed^{-1}		Total outputs L.E fed^{-1}	Total inputs L.Efed^{-1}	Net income L.E fed^{-1}	I.R*	Average yield Ton fed^{-1}	Total outputs L.E fed^{-1}	Total inputs L.Efed^{-1}	Net income L.E fed^{-1}	I.R*
			grain	stow	grain	straw									
Ammonium Nitrate 33.5%	Zero	Zero	0.831	1.11	1770.0	532.8	2302.8	1665	637.8	1.38	0.500	550.0	1422	-872	0.387
		30	0.895	1.23	1906.4	590.4	2496.8	2925	-428.2	0.85	0.803	883.3	2682	-1798.7	0.3291
		40	1.093	1.53	2328.1	734.4	3062.5	3345	-282.5	0.92	0.888	976.8	3102	-2125.2	0.315
	75%	Zero	1.700	2.99	3621.0	1435.2	5056.2	2336	2720.2	2.16	2.618	2879.8	2637	242.8	1.091
		30	2.607	5.138	5552.9	2466.2	8019.1	3596	4423.1	2.23	3.595	3954.5	3353	601.5	1.179
		40	2.625	5.135	5591.3	2464.8	8056.1	4016	4040.1	2.01	3.670	4037.0	3773	264	1.069
	100%	Zero	2.440	4.58	5197.2	2198.4	7395.6	3560	3835.6	2.08	3.383	3721.3	3124	596.8	1.191
		30	2.658	5.253	5661.5	2521.4	8182.9	3820	4362.9	2.14	3.688	4056.8	3577	479.8	1.134
		40	2.658	5.195	5661.5	2493.6	8155.1	4240	3915.1	1.92	3.800	4180.0	3997	183	1.046
Ammonium sulphate 20 %	Zero	Zero	0.820	1.088	1746.6	522.3	2268.9	1665	603.9	1.39	0.504	554.4	1422	-867.6	0.388
		30	0.885	1.216	1885.1	583.7	2468.8	2925	-456.2	0.84	0.788	866.8	2682	-1815.1	0.323
		40	1.098	1.53	2338,7	734.4	3073.1	3345	-271.9	0.92	0.903	993.3	3102	-2108.7	0.320
	75%	Zero	2.095	3.08	4462.4	1478.4	5940.8	3600	3150.8	2.13	2.635	2898.5	2637	261.5	1.099
		30	2.66	5.33	5665.8	2558.4	8224.2	2790	4624.2	2.28	3.65	4015.0	3357	658	1.196
		40	2.66	5.33	5665.8	2558.4	8224.2	4020	4204.2	2.05	3.728	4100.8	3777	323.8	1.086
	100%	Zero	2.485	4.765	5293.1	2287.2	7580.3	3565	4015.3	2.13	3.390	3729.0	3421	308	1.090
		30	2.695	5.305	5740.4	2546.4	8286.8	3825	4460.8	2.17	3.413	3754.3	3582	172.3	1.048
		40	2.748	5.403	5853.2	2593.4	8446.6	4245	4201.6	1.99	3.830	4213.0	4002	211	1.053

Conclusion:

On the basis of the presented data and under the same of experimental conditions, data indicated that the application of farmyard manure markedly improved soil hydro-physical properties, i.e. soil penetration resistance, total porosity, hydraulic conductivity, available water and infiltration rate. Also data revealed that about 25% of mineral nitrogen fertilizer for wheat or maize Crops could be saved by applying about30 m^3 fed-1 farmyard manure. These results were incorporated with the height crop yield and net income and investment ratio. Further and more detailed studies are needed on a narrower range of applied mineral fertilization in order to formulate a better guideline for combining the farmyard manure and mineral fertilizer application.

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