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RESPONSE OF YELLOW MAIZE PRODUCTIVITY AND QUALITY TO INTEGRATION BETWEEN MINERAL AND ORGANIC NITROGEN FERTILIZERS UNDER NEWLY RECLAIMED SOILS CONDITIONS

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ABSTRACT

Two field experiments were carried out at a private farm (newly reclaimed soil) at Somusta city, Bani-Suif governorate, Egypt, during 2014 and 2015 growing seasons. These experiments aimed to evaluate the application of different nitrogen sources and their combinations for increasing the productivity and quality of yellow maize (*zea mays*). Results showed that:

Maize plants fertilized with 120 kg MN/fad. recorded the greatest leaves number/plant (12.67) and number of green leaves /plant (12.67) after 45 days from sowing, however, the applied application of 60 kg MN/fad + 60 kg ONP /fad gave the maximum number of leaves /plant (15.17 and 17.83) and number of green leaves /plant (15.17 and 16.33) at stages of vegetative growth after 60 and 75 days from sowing, respectively. application of 60 kg MN/fad + 60 kg ONP /fad gave the highest values of leaf area index (LAI) at all stages of vegetative growth 3.16, 3.98 and 6.39 from 45, 60 and 75 days from sowing, respectively.

At harvest maize plants fertilized with 60 kg MN/ fad + 60 kg ONP /fad recorded the highest value of grains number/row (32.83) followed by 60 kg MN/fad + 60 kg ONC/fad. the highest values of ears number/plant were recorded with the treatments 60 kg MN/ fad + 60 kg ONC /fad, 60 kg MN/fad + 60 kg ONP/fad and 60 kg MN/fad + 60 kg ONF/ fad with the same value (2.00). Data also revealed that the highest value of grain weight/plant (274.49) was recorded at 60 kg MN/fad + 60 kg ONP/fad treatment.

Application of 60 kg MN/fad + 60 kg ONP/fad produced significant maximum grain yield (3.05 ton/fad.), biological yield (6.37 ton/fad) and grain crude protein yield (296.83 kg/fad).

Maize plants treated with 60 kg MN/fad + 60 kg ONP/fad gave the highest values of grain and straw nitrogen percentage by 1.17 and 0.42% respectively. In addition the highest values of grain and straw phosphor percentage (0.49 and 0.20 %) and potassium percentage (4.30 and 1.90%) respectively were recorded with 120 kg ONP/fad.

INTRODUCTION

Maize is one of the most important cereal and forage crop. In Egypt the area and production of yellow maize represented about 15% of the total maize area in 2010/2011, increased to 21.37% in 2013/2014 and the rest was white corn. In 2010/2011, area cultivated with yellow maize was 247 thousand faddan increased to 467 thousand in 2013/2014 and production increased from 805 thousand ton in 2010/2011 to 1534 thousand ton 2013/2014.

The most reclaimed soils in Egypt are generally low in organic matter newly soils contain (less than 1%). This decrease may be due to firstly, the arid climate resulting in a rapid decomposition of organic matter and secondly, little organic matter added to the soil. Thus crops requirements from chemical fertilizer increased to compensate fertility shortfall of newly reclaimed soil.

In Egypt there are some problems related to chemical nitrogen fertilizers such as inadequate supply or even unavailability of fertilizer at the time of applied, adulteration and high cost. Further, continuous use of chemical fertilizers creates potential polluting effect in the environment in addition pro-

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duction of chemical nitrogen fertilizers consumes a large amount of energy and cost. Hence, combination between chemical and organic nitrogen fertilizers seems to be successful solution for these problems. The integration between organic sources with chemical sources of nitrogen not only supply crops with nitrogen requirements but also have some positive interaction with chemical fertilizer to increase their efficiency and thereby reduce environmental pollution. Organic manures contribute to plant growth through their favorable effects on the physical, chemical and biological properties of soil. The availability of soil N is enhanced by addition of manures, presumably due to chelation of cations by organic acids and other decay products (**Mohanty et al 2006**). **Negm et al (2003)** reported that the beneficial effects of organic manures as well as micronutrients for increasing the productivity of sandy soils as a result of increasing the bio-available micronutrients (*i.e,* Fe, Mn, Zn and Cu) and cation exchange capacity. Also, such beneficial effects positively reflected on soil organic matter content as well as the dry weight and the plant contents of Fe, Mn, Zn and Cu at the vegetative and elongation stages of maize (**Abd el aziz et al 2002**). In addition **Badawy (2008)**, found that applying organic manure to sandy soils plays an important role for improving soil media throughout modifying the pore size distribution, and consequently the majority of soil physical properties, *i.e.,* bulk density, moisture constants, hydraulic conductivity, water consumptive use and water use efficiency.

Nitrogen element plays a very important role in maize crop development because it is not only an integral part of structural and functional proteins, chlorophyll and nucleic acids (RNA and DNA) but also it is very essential for the proper utilization of carbohydrate. Leaf area index, leaf area duration, rate of leaf expansion, photosynthetic rate, radiation interception and radiation use efficiency also increase with increase in the supply of N. Crude protein concentration is also improved by proper N supply.

The aims of this study were to reduce the amount of mineral nitrogen fertilizers added to yellow maize plants by substituting their partial amounts with organic nitrogen from different sources, decrease environment pollutions, increase yield and quality of yellow maize as well as improve fertility of newly reclaimed soil.

MATERIALS AND METHODS

Two field experiments were carried out at a private farm (newly reclaimed soil) at Somusta city, Bani- Suif governorate , Egypt, during 2014 and 2015 growing seasons to investigate the effect of integration between different sources of nitrogen (N) on yellow maize (*zea mays*), single cross Giza 176 hybrid (obtained from Agricultural Research Center, Giza, Egypt). The experiment included 11 nitrogen treatments as follows: control (without fertilizer), 120kg mineral nitrogen (MN)/fad. (as ammonium nitrate 33.5% N), 120kg organic N (ONF)/fad.(from farmyard manure (FYM), 120kg ONP/ fad. (from Poultry Manure P.M), 120kg ONC/fad (from compost), 60 kg M N/fad + 60 kg ONF /fad, 60 kg M N/fad + 60 kg ONP/fad., 60 kg M N/fad + 60 kg ONC/fad 30 kg MN/fad + 90 kg ONF/fad, 30 kg MN/fad + 90 kg ONP/fad and 30 kg/fad MN + 90 kg ONC/fad.

The fertilizer treatments were arranged in randomized complete block design in four replicates. The experimental unit area was 16 m^2 consisted of 5 ridge each of 4 m in length and 80 cm apart, whereas, one ridge side, 25 cm between hill and one plant per hill was planted. The organic fertilizers were applied per-sowing. Mineral N fertilizer rates were applied into three equal rates, the first portion was added at 15 days from sowing just before irrigation and the second portion was added at 30 days from sowing just before irrigation and the third portion was added at 45 days from sowing just before irrigation. In the both seasons the previous cultivated crop was sugar beet. Seeds of yellow maize were sown on 18 May and 22 May in the first and second growing seasons, respectively. Irrigations system applied was drip irrigation. Normal agricultural practices of yellow maize were applied in sandy soil as recommended. Soil samples form 0-30 cm depth before planting were taken to determine mechanical and chemical properties of the experimental soil as shown in **Table 1.**

Table 1. Mechanical and chemical analysis of the experimental soil

Sand %			Silt %		Clay%	Soil texture	
96.02			1.70		2.28	sandy	
Cations (meq/L)				**Anions (meq/L)**		**pH**	**EC (ds/m)**
Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}		
4.6	5.3	145	0.8	0.6	133	8.2	2.3

Data recorded

Sail properties

Before planting and after harvesting, sail simply at 0-30 cm depth were taken from each experimental unit to evaluate total N, organic matter, available P and available K according to **AOAC (1995)**. .

Growth attributes

At the different stages of growth, (45, 60 and 75 days after planting) 10 plants were selected at random from each treatment to determine plant height (cm), number of total leaves/plant, number of green leaves/plant and leaf area index (LAI).

Data resided at harvest

At harvest, a sample of 10 plants were collected at random to measure plant height (cm), number of ears/plant, number of grains/row, 100- grain weight (g), grain weight (g)/ear, grain weight (g)/plant. Moreover, grain yield (ton/fad), biological yield (ton/fad) (calculated from yield of experimental unit). Also, harvest index (HI %) in terms of grain yield (ton/fad) X 100/biological yield (ton/fad) was calculated.

Quality measurements

About 50g of grains were fine grinding to determine nitrogen percentage (N%) using microKjeldal method according to **AOAC (1995)**. The crude protein content (GCPC) was calculated by multiplying total N% by 5.7. The grain crude protein yield (GCPY kg/fad) was calculated by multiplying grain yield (kg/fad) by grain crude protein content (GCPC %).

The accumulated total nitrogen in grains and straw was estimated according to **AOAC (1995)** to calculate nitrogen physiological parameters including N recovery efficiency % (NRE, kg N absorbed per 100/kg N applied/fad), nitrogen use efficiency (NUE, grain yield (kg/fad)/kg N applied/fad), nitrogen harvest index (NHI, total N in grains per 100/total N uptake) and nitrogen physiological efficiency (NPE, grain yield (kg/fad)/N absorbed/fad) were calculated according to **Timsina et al (2001).** Agronomic efficiency of applied fertilizer N (NAE) = (Grain yield /fad with fertilizer – grain yield of control without fertilizer) / Quantum of applied N fertilizer, was computed according to **Mohsin et al (2011).**

Phosphorus determination

In an acid mixture of HNO_3 and HCLO4, samples were digested. Then phosphorus was determined by developing color by color reagent (ammonium molybdate, ammonium vanadate and nitric acid) with a spectrophotometer ANA-730 at 470 nm wavelength after calibrating with P standards **AOAC (1995).**

Potassium determination

Corning flame photometer was used to determine the potassium after calibrating the instrument with K standards **AOAC (1995).**

Economic evaluation

In the present study, the economic evaluation of the different treatments was calculated via three estimates as follows:

1. Total cost of maize production as affected by rates and sources of N fertilizers. The other recommended agricultural practices for growing maize were constant under different treatments so, that they were excluded from the economic evaluation.
2. Total income of maize according to the actual price of grains yield as affected by the studied treatments.

3. Net farm income of maize production as affected by the studied treatments.

Statistical analysis

All the obtained data were exposed to the proper statistical analysis according to **Snedecor and Cochran (1967)**, using Costat computer program **V 6.303 (2004).** LSD at 5% level as significance was used to differentiate between means. Data of 2014 and 2015 growing seasons were subjected to homogeneity variance test for running the combined analysis of the data**.**

RESULTS AND DISCUSSION

1. Soil chemical characteristics

Due to the important role of soil additions in manipulating the edaphic conditions, chemical characteristics of the experimental soil were evaluated after harvesting of maize plants at 0-30 cm depth as affected by integrated chemical and organic nitrogen fertilization. Data in **Table 2** indicate discrepancy in the concentration of total nitrogen and organic matter in solid phase of the soil as well as available phosphorus and potassium in liquid phase of soil. Tata showed that added organic fertilizers (poultry manure, farmyard manure and compost) only or combined with mineral nitrogen increased to different extents the soil nitrogen, organic matter and available phosphorus and potassium. The total nitrogen of soil before sowing was 0.01% and increased after harvest by applying 60 kg MN/fad + 60 kg ONP/fad scored maximum value (0.29%) followed by 30 kg MN + 90 kg ONP treatment. The organic matter in soil was 0.09 % before sowing maize and applying 120 kg ONF/fad increased its concentration after harvest to 3.12%, whereas the other studied treatments had considerable favor effects on soil organic matter. The soluble phosphate anions (mono- and dihydrogen phosphate) in soil solution and total available potassium were 0.01 and 0.8 g/kg soil, respectively. These amounts were increased to 0.1, 0.08 and 0.06 g phosphorus, 3.1, 3.1 and 2.9 g potassium/kg soil as a result of applying 120 kg ONP/fad, 120 kg ONC/fad and 120 kg ONF/fad respectively.

Table 2. Chemical analysis of the experimental soil before planting and after harvest as affected by integrated organic and mineral nitrogen fertilizer. (Combined data of 2014/2015 growing seasons)

Treatments (kg/fad)	Total nitrogen %	Organic matter %	Available g/kg soil	
			P	K
Pre planting	0.01	0.09	0.01	0.8
After harvest				
120 kg ONF	0.12	3.12	0.06	2.9
120 kg ONP	0.21	2.23	0.1	3.1
120 kg ONC	0.22	2.54	0.08	3.1
30 kg MN + 90 kg ONF	0.14	2.53	0.05	2.6
30 kg MN + 90 kg ONP	0.24	1.83	0.08	2.7
30 kg MN + 90 kg ONC	0.19	2.19	0.06	2.2
60 kg MN + 60 kg ONF	0.17	1.60	0.02	2.9
60 kg MN+ 60 kg ONP	0.29	1.19	0.07	2.5
60 kg M N + 60 kg ONC	0.2	1.43	0.05	2.3
120kg M N/fad	0.13	0.05	0.01	0.8
Control (without)	0.01	0.12	0.01	0.8

ONF = organic nitrogen from farmyard Manure ONP= organic nitrogen from poultry manure
ONC= organic nitrogen from compost MN= mineral nitrogen

2. Growth traits

Our finding reveal that different nitrogen fertilizer sources significantly affected plant height at all growth periods, whereas the highest plants were recorded when maize plant was fertilized with 60 kg MN/fad + 60 kg ONP/fad. after 45, 60 and 75 days from sowing **Table 3**. The plant height was markedly increased by advancing the plants towards maturity. Number of leaves /plant and number of green leaves/plant were affected by different nitrogen fertilizer sources at early stage of vegetative growth (after 45 days from sowing), application of 120 kg MN /fad. recorded the greatest number of leaves/plant (12.67) and number of green leaves/plant (12.67). It is not worthy to mention that either poultry manure as a slowly release nitrogen treatment or its combination with another ones were more effective, however, the applied application of 60 kg MN/fad + 60 kg ON/fad (as poultry manure) treatment gave the maximum number of leaves/plant (15.17 and 17.83) and number of green leaves /plant (15.17 and 16.33) at stages of vegetative growth (60 and 75 days from sowing, respectively). From the above mentioned application of 60 kg MN/fad + 60 kg ON/fad (as poultry manure) had the highest values of leaf area index (LAI) at all stages of vegetative growth (from 45, 60 and 75 days from sowing) by 3.16, 3.98 and 6.39 respectively. Similar finding was obtained by **Nasim et al (2012)** who found that applying poultry manure (8 ton/ha) + mineral nitrogen (100 kg/ ha) gave the highest values for each plant height, Leaf area index at tasseling stage. That is true, since poultry manure, as an organic substance, has been found to a profound effect not only on the biological activity and soil structure, but also on plant itself. This is due to its positive effect on the increment in bio-released plant nutrients and their availability to be uptake by the growing plant. These results are in harmony with those reported by **Nasim et al (2012) and Bakry et al (2009)** who found the favorable conditions achieved in soil as a result of the applied organic manure are commonly associated with lowering soil pH and forming organometalic compounds (*i.e.,* the chelated micronutrients), which represented the next superior form due to a higher portion of these compounds still in maintained active forms for uptake by plant roots. In addition, adding organic manure resulted in increasing crop productivity as a result of increasing soil bioavailability of micronutrients (*i.e,* Fe, Mn, Zn and Cu) and cation exchange capacity in the newly reclaimed soils, and in turn markedly increased the dry weight and the plant contents of these nutrients at the vegetative growth of maize.

Table 3. Effect of different nitrogen sources and their combinations on maize growth traits (after 45, 60 and 75 days from sowing)

Treatments (kg/fad)	plant height			No. of leaves/ plant			No. of green leaves/ plant			Leaf area index		
	45 days	60 days	75 days	45 days	60 days	75 days	45 days	60 days	75 days	45 days	60 days	75 days
120 kg ONF	113.32	142.13	169.85	10.33	12.83	13.83	10.33	12.00	10.50	2.04	2.79	4.30
120 kg ONP	121.82	155.48	191.50	10.83	13.67	14.83	10.83	13.00	12.00	2.15	2.97	4.64
120 kg ONC	120.62	151.43	180.25	10.50	13.67	14.50	10.50	12.67	11.67	2.03	2.90	4.41
30kg MN + 90 kg ONF	120.33	153.93	190.10	10.50	13.17	14.17	10.50	12.83	11.50	2.18	2.94	4.62
30kg MN + 90 kg ONP	124.83	176.60	203.27	11.00	14.50	15.17	11.00	14.50	13.00	2.19	3.37	5.64
30kg MN + 90 kg ONC	122.78	163.23	193.75	10.83	14.00	14.50	10.83	14.00	12.17	2.15	3.125	5.13
60kg MN + 60 kg ONF	135.82	185.20	204.05	11.83	14.33	15.50	11.83	14.33	14.00	2.43	3.26	5.64
60 kg MN+ 60 kg ONP	153.17	198.45	227.52	12.50	15.17	17.83	12.50	15.17	16.33	3.16	3.98	6.39
60kg MN + 60 kg ONC	148.97	189.73	210.85	12.00	14.67	16.50	12.00	14.67	14.67	2.76	3.62	5.93
120kg M N/fad	151.77	177.78	203.73	12.67	14.00	15.17	12.67	13.17	9.17	2.84	3.06	4.37
Control (without)	83.88	105.00	130.45	7.33	11.83	13.00	7.17	10.17	4.83	1.23	2.28	3.14
LSD	6.80	7.25	9.04	0.69	0.75	0.68	0.68	0.80	0.82	0.21	0.39	0.57

ONF = organic nitrogen from farmyard Manure
ONP= organic nitrogen from poultry manure
ONC= organic nitrogen from compost
MN= mineral nitrogen

3. Yield components

Data in **Table 4** demonstrated the significant effects of nitrogen sources and their combination on yield components (number of grains/row, number of ear/plant, 100 grain weight, grain weight/ear and grain weight/plant) of maize. Maize plants fertilized with 60 kg MN/fad + 60 kg ONP/fad recorded the highest value of grains number/row (32.83 grains/ row) followed by 60 kg MN/fad + 60 kg ONC/fad. On the contrary, the lowest value (11.00 grains/row) recorded with the control treatment (without nitrogen fertilizer). Concerning the effect of nitrogen sources on number of ears/ plant data in **Table 4** showed that the highest values were recording with the treatments 60 kg M N/fad + 60 kg ONC/fad, 60 kg MN/fad + 60 kg ONP/ fad and 60 kg MN/fad + 60 kg ONF/ fad with the same value (2.00). The variations between the treatments i.e., 30 kg MN/fad + 90 kg ONC/fad, 30 kg MN/fad + 90 kg ONP/fad, 30 kg MN/fad + 90 kg ONF/fad, 120 kg ONC/ fad, 120 kg ONP/fad. and 120 kg ONF/fad not great enough to reach the significant levels in number of ears/plant. On the other hand, the lowest values (1.33 and 1.00) of ears number/plant were recorded with 120kg M N/fad and control treatment (without fertilizer). Data also affirmed that the highest value of 100 grain weight (33.60) was recorded with the control treatment. The superiority of this treatment may be due to the decrease in the number of grains/row which has led to larger gain filling. Regarding the effect of nitrogen sources on grains weight/ear data pointed out that maize plants fertilized with 60 kg MN/fad + 60 kg ONP/fad gave the highest value (137.20 g). On the other hand, non-fertilized plots recorded the lowest value of grain weight/ear (51.81 g).

Data also revealed that the highest value of grain weight/plant (274.40) was recorded at 60 kg M. N + 60 kg ONP /fad treatment followed by 60 kg M.N + 60 kg ONC /fad and 60 kg M.N + 60 kg ONF treatments by 239.63 and 221.35 (g) respectively. This increase in grain weight/plant was consistent with the increases in grain weight /ear, number ear / plant and number of grains / row for the seam previous treatments. While the lowest value (51.81 g) was recorded at the control treatment.

Table 4. Effect of different nitrogen sources and their combinations on yield components at harvest (after 95 days from sowing)

Treatments (kg/fad)	No. of Grains/row	No.of ear / plant	100 grain Wieght (g)	Grain weight/ ear (g)	Grain weight/ plant (g)
120 kg ONF	24.00	1.67	25.50	85.66	141.92
120 kg ONP	26.50	1.67	26.10	96.98	162.33
120 kg ONC	25.50	1.67	25.43	90.83	150.62
30 kg MN + 90 kg ONF	25.50	1.67	26.53	94.67	156.22
30 kg MN + 90 kg ONP	28.50	1.67	27.57	110.01	183.55
30 kg MN + 90 kg ONC	27.00	1.67	26.42	99.94	167.74
60 kg MN + 60 kg ONF	29.00	2.00	27.25	110.67	221.35
60 kg MN+ 60 kg ONP	32.83	2.00	29.83	137.20	274.40
60 kg M N + 60 kg ONC	30.17	2.00	28.28	119.82	239.63
120kg M N/fad	22.17	1.33	29.50	91.31	123.71
Control (without)	11.00	1.00	33.60	51.81	51.81
LSD	3.05	0.54	1.17	11.88	56.76

ONF = organic nitrogen from farmyard Manure ONP= organic nitrogen from poultry manure
ONC= organic nitrogen from compost MN= mineral nitrogen

4. Yield

Grain yield was significantly affected by different nitrogen source **Table 5**. Application of 60 kg MN/fad + 60 kg ONP/fad was characterized by significant highest yield attributes, which reflected on its grain yield (3.05 ton/fad.). The highest grain yield of maize can be attributed to more number of ear/plant, 100 grain weight, grain weight /ear and grain weight/plant due to application of 60 kg MN/fad + 60 kg ONP/fad **Table 4**. Using 60 kg MN/fad + 60 kg ONP/fad may serve as an alternative to chemical fertilizer at the rate used in this study and may be recommended. The treatments with sole organics and organics integrated with mineral fertilizers increased the maize grain yield in comparison to the recommended rate of the sole mineral fertilizer. Generally, the maize grain yields were lower for the treatments with fertilizer alone compared to treatments with sole organic or organic combined with mineral fertilizers. This implies an increased nutrient recovery in the sole organic and organic plus mineral fertilizer treatments compared to sole mineral fertilizer treatment. These results are in accordance with **Boateng et al (2006); Ayeni and Adetunji (2010) and Mugendi et al (2010).** From the above mentioned data in **Tables 3 and 4**, it could be concluded that the higher yield attributes and higher grain yield led to higher biological yield (6.37 ton/fad). On other hand, GCPY and HI were significantly affected by different nitrogen sources. The treatment 60 kg MN/fad + 60 kg ONP/fad produced the highest value of GCPY (296.83 kg/fad). Adding 60 kg MN/fad + 60 kg ONC/fad produced the maximum harvest index (51.33 %). Results also corroborate with **Nasim et al (2012)** who also noted the positive effects of fertilizers (organic and inorganic) combined with each other and he indicated clearly the vital role of N in plant life and its contribution in increasing the grain yield. Such results clarified that N is an element essential for cell division and elongation as well as the root growth and dry matter content of maize plants **(El-Gizawy and. Salem 2010)**.

Table 5. Effect of different nitrogen sources and their combinations on yield and harvest index at harvest (after 95 days from sowing)

Treatments (kg/fad)	Grain yield (ton/fad)	GCPY (kg/fad)	Biological yield(ton/fad)	HI %
120 kg ONF	2.12	161.14	4.45	47.66
120 kg ONP	2.37	196.98	5.12	46.29
120 kg ONC	2.27	185.71	4.69	48.59
30 kg MN + 90 kg ONF	2.36	192.34	4.91	48.56
30 kg MN + 90 kg ONP	2.64	231.53	5.73	46.29
30 kg MN + 90 kg ONC	2.47	212.14	4.90	50.75
60 kg MN + 60 kg ONF	2.71	241.68	5.47	49.76
60 kg MN+ 60 kg ONP	3.05	296.83	6.37	47.84
60 kg M N + 60 kg ONC	2.89	271.61	5.64	51.33
120kg M N/fad	1.71	150.65	5.11	33.44
Control (without)	0.94	84.19	3.62	26.16
LSD	**0.25**	**23.28**	**0.47**	**6.22**

ONF = organic nitrogen from farmyard Manure ONP= organic nitrogen from poultry manure
ONC= organic nitrogen from compost MN= mineral nitrogen
GCP Y= grain crude protein yield HI = harvest index fad = 4200 m^2

5. Chemical analysis

Concerning the effect of the applied treatments on maize grain content of some macronutrients *i.e.,* N, P and K and GCPY data in **Table 6** revealed that N, P, K and grain crude protein of maize were affected significantly by different nitrogen sources. There were increases in N, P and K in maize concentration in all the treatments that contained the poultry manure. As in yield and yield component parameters, the application of 60 kg MN/fad + 60 kg ONP/fad treatment gave maximum N% (1.71%) and grain crude protein content (9.74%), but was statistically at par with application of 60 kg MN/fad + 60 kg ONC/fad which recorded 1.647 and 9.39% respectively. On the contrary, the highest values of K (4.3%) and P (0.49%) were observed in application of 120 kg ONP/fad. These results are agreed with early findings **Ayeni and Adetunji (2010)** therefore, it is ascertained that poultry manure released the macronutrients for maize, which were utilized for growth and grain formation.

Data illustrated in **Table 6** clear the significant effect of nitrogen treatments on contents of nitrogen (N), phosphorus (p) and potassium (k) in maize straw. Applied 60 kg M N/fad + 60 kg ONP/fad achieved the highest value of nitrogen percentage by 0.416 % in maize straw. On the other hand, the lowest value (0.065) of N% in straw was recorded with control treatment. As for the response of P % in straw, the highest value (0.17%) was recorded with 30 kg MN /fad + 90 kg ONP/fad treatment. The superiority of this treatment may be due to the high phosphor content in poultry manure fertilizer. **Naveed et al (2008)** showed that maize plant treated with compost + mineral fertilizer gave significant increase in nitrogen, phosphorus and potassium % uptake.

Table 6. Effect of different nitrogen sources and their combination on grain and straw NPK content and grain crude protein percentage

Treatments (kg/fad)	N %		P %		K %		GCP %
	Grains	Straw	Grains	Straw	Grains	Straw	
120 kg ONF	1.34	0.15	0.37	0.13	3.30	1.40	7.61
120 kg ONP	1.46	0.24	0.49	0.20	4.30	1.90	8.32
120 kg ONC	1.44	0.19	0.41	0.15	3.70	1.70	8.19
30 kg MN + 90 kg ONF	1.43	0.21	0.32	0.11	2.90	1.10	8.15
30 kg MN + 90 kg ONP	1.54	0.22	0.42	0.17	4.10	1.90	8.77
30 kg MN + 90 kg ONC	1.51	0.29	0.36	0.13	3.60	1.50	8.58
60 kg MN + 60 kg ONF	1.56	0.28	0.26	0.09	2.50	0.09	8.91
60 kg MN+ 60 kg ONP	1.71	0.42	0.32	0.11	3.40	1.30	9.74
60 kg M N + 60 kg ONC	1.65	0.33	0.27	0.09	3.00	1.10	9.39
120kg M N/fad	1.55	0.24	0.11	0.02	1.90	0.04	8.81
Control (without)	1.58	0.07	0.31	0.11	3.10	0.09	8.98
LSD	**0.23**	**0.03**	**0.03**	**0.01**	**0.16**	**0.03**	**0.49**

ONF = organic nitrogen from farmyard Manure
ONP= organic nitrogen from poultry manure
ONC= organic nitrogen from compost
MN= mineral nitrogen
GCP= grain crude protein

6. Nitrogen physiological parameters:

Grain and straw nitrogen content were estimated to evaluate nitrogen physiological parameters as affected by studied different nitrogen sources applied. Data of NAE, NRE, NUE, NPE and NHI computed traits were varied considerably depending on different nitrogen sources. **Table 7** shows that application of 60 kg MN/fad + 60 kg ONP/fad had the highest values of NAE (16.56), NRE (54.90%) and NUE (43.40 kg grains/kg nitrogen applied). While NPE regarding different nitrogen sources application found maximum value (66.54) with 120 kg ONF/fad application. On the other hand, nitrogen harvest index (NHI) exhibiting maximum value (89 %) with 120 kg MN /fad only or with 120 kg ONF /fad only. It was also found a positive trend between NUE and NRE%.

Table 7. Effect of different nitrogen sources and their combinations on nitrogen physiological parameters

Treatments (kg/fad)	NAE	Total N	NUE	NHI%	NPE	NRE%
120 kg ONF	8.81	31.83	23.56	89.00	66.54	26.52
120 kg ONP	10.90	41.18	28.80	84.00	57.48	34.32
120 kg ONC	10.06	37.14	27.15	88.00	61.04	30.95
30 kg MN + 90 kg ONF	10.83	38.97	28.12	87.00	60.56	32.48
30 kg MN + 90 kg ONP	13.17	47.49	33.85	85.00	55.49	39.58
30 kg MN + 90 kg ONC	11.77	44.33	31.01	84.00	55.76	36.94
60 kg MN + 60 kg ONF	13.77	49.99	35.33	85.00	54.26	41.66
60 kg MN+ 60 kg ONP	16.56	65.88	43.40	79.00	46.20	54.90
60 kg M N + 60 kg ONC	15.27	56.68	39.71	84.00	51.02	47.23
120kg M N/fad	5.42	34.60	22.03	76.00	49.06	28.83
Control (without)	-	16.51	-	89.00	56.44	-
LSD	**2.18**	**3.83**	**3.40**	**3.00**	**2.25**	**3.19**

ONF = organic nitrogen from farmyard Manure ONP= organic nitrogen from poultry manure
ONC= organic nitrogen from compost MN= mineral nitrogen

7. Economic study

Data of fertilizer treatments net return as shown in **Table 8** can be arranged in respective descending order as follows, i.e. 60 kg M N/fad+ 60 kg ONP/fad, 60 kg M N/fad + 60 kg ONC/fad, 60 kg M N/fad+ 60 kg ONF/fad, 30 kg MN/fad + 90 kg ONP/fad , 30 kg MN/fad + 90 kg ONC/fad, 120 kg ONP/fad , 30 kg MN/fad + 90 kg ONF/fad , 30 kg MN/fad + 90 kg ONF/fad , 120 kg ONC/fad, 120 kg ONF/fad , 120kg MN/fad and control (without fertilizer). Thus the integration between mineral nitrogen (at rate of 60 kg N/fad) with both of poultry manure, compost and farmyard manure showed superiority in net return values respectively**.** In addition there were many advantages that could be achieved by the application of organic fertilizers for certain reasons, which mainly improved soil physical, chemical and biological traits. These improvements include the increase of organic matter, available nitrogen, phosphorus, potassium and micro nutrients. Similar finding was obtained by **Badawy (2008)** who found that applying organic manure to sandy soils plays an important role for improving soil media throughout modifying the pore size distribution, and consequently the majority of soil physical properties, *i.e.,* bulk density, moisture constants, hydraulic conductivity, water consumptive use and water use efficiency. **Negm et al (2003)** reported that the beneficial effects of organic manures as well as micronutrients for increasing the productivity of sandy soils as a result of increasing the bio-available micronutrients (*i.e.,* Fe, Mn, Zn and Cu) and cation exchange capacity.

Also, such beneficial effects positively reflected on soil organic matter content as well as the dry weight and the plant contents of Fe, Mn, Zn and Cu at the vegetative and elongation stages of maize. In addition, organic fertilizers have a considerable effect on reduction the environmental pollution comparing to applying the mineral fertilizers alone.

Table 8. Total costs, total return and net return (L.E./fad) due to mineral nitrogen , organic and their combination fertilizers (average of 2014 and 2015 growing seasons).

Treatments (kg/fad)	Cost (LE)		Cost (LE) of nitrogen unit		Total cost (LE)	Total return (LE)	Net return (LE)
	M N	O N	MN	O N			
120 kg ONF	---	1863	---	15.5	1863	4942	3079
120 kg ONP	---	1312	---	10.9	1312	5523	4211
120 kg ONC	---	1483	---	12.4	1483	5292	3809
30 kg MN + 90 kg ONF	272	1397	2.3	11.6	1669	5505	3836
30 kg MN + 90 kg ONP	272	984	2.3	8.2	1256	6160	4904
30 kg MN + 90 kg ONC	272	1112	2.3	9.3	1384	5768	4384
60 kg MN + 60 kg ONF	545	931	4.5	7.8	1476	6328	4852
60 kg MN+ 60 kg ONP	545	656	4.5	5.5	1201	7112	5911
60 kg M N + 60 kg ONC	545	741	4.5	6.2	1286	6748	5462
120kg M N/fad	1090	---	9.1	0.0	1090	3990	2900
Control (without)	---	---	---	---	0	2187	2187

ONF = organic nitrogen from farmyard Manure ONP= organic nitrogen from poultry manure
ONC= organic nitrogen from compost MN= mineral nitrogen

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