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CHANGES IN NITROGEN CONTENT IN DIFFERENT SOIL LAYERS AFTER APPLICATION OF COMPOSTED AND FRESH CHICKEN MANURE AND NITROGEN MINERAL DURING MAIZE AND WHEAT CULTIVATION IN SANDY SOIL

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ABSTRACT

Two field experiments were successively conducted to study the effect of applied composted of chicken manure (CCM) and fresh chicken manure (FCM) as organic N sources, either individually or in mixture with different ratios of ammonium sulfate ($(NH_4)_2SO_4$) as inorganic N source on the growth, yield and yield traits of maize and wheat as well as some properties of soil. Treatments included combination of both $(NH_4)_2SO_4$ and organic N sources. Such treatments represent ratios of inorganic100%, inorganic 75%+organic25%, inorganic50% + organic50%, inorganic25% +organic75% and organic100%. The N application rate in all amended plots was kept at 120 kg/fed. Different parameters were tested to evaluate the ability of composted or fresh chicken manure to meet N demand of maize and wheat crops in sandy soil (Ismaillia Agric. Research Station). Some soil chemical parameters were monitored; namely on i.e., EC, O.M content, available P and K after harvest of both maize and wheat plants. Distribution of NH_4 –N and NO_3-N in different soil layers (0-15 cm, 15-30cm and 30-45cm) as investigated during growth stages for both plants; after (15,30 and 120 or 150 days from planting of maize and wheat, respectively). Some factors which may affect N- mineralization i.e., soil temperature, pH and moisture content were also evaluated.

Incorporation of ammonium sulfate and organic N sources increased the amounts of soil organic matter content, available P and K in soil and pH values but decreased EC values in soil after maize and wheat harvesting. However, the magnitude of this effect was more pronounced with the mixture of 75% inorganic N+CCM25% and inorganic N 50% + FCM50%. However, the organic matter content increased with increasing the organic N through the applied to amendment to the soil. On the other hand, both N sources applied caused a substantial increase in the soil N availability, most of this increase was due to inorganic N. The release of available N (NH_4^+ and NO_3^-) from organic sources was slow, steady and took a long time. The combination between inorganic and organic N resulted in greater values of NH_4^+ and NO_3^- release than those obtained when each was applied singly, specially after 30 days from maize planting. The results also indicate that, grain yield of maize and wheat and their concentrations of N, P, K and protein content were increased by incorporation of inorganic and organic N sources. The addition of 75% N in organic form (composted and fresh chicken manures) and the rest in mineral form produced almost the same yield of both maize and wheat plants as in the case of 100% organic N sources.

Key words: composted chicken manure (CCM), Fresh chicken manure (FCM), N availability, ammonium- N, nitrate-N, maize and wheat yields.

INTRODUCTION

Crop residues and other organic materials which available in farms are an important component in sustainable cropping systems especially where access to external inputs such as N fertilizers is limited. Residues in such systems provide a rich source of nutrients for plants and a readily available source of organic matter and nutrients particularly N for soils. Management of crop residues also influences the use efficiency of applied fertilizers and availability of N to the crops. For example, when good quality (low C/N ratio) residues are added to the soil, a large amount of N is released during the decomposition period, thus reducing the use efficiency of added fertilizers (Seneviratne, 2000). Surface fertilization with chicken manure, which may contain up to 89% N in the NH_4^+ form, can result in losses due to volatilization of NH_3 or leaching of nitrates (Beauchamp, 1986). Since the rate of ammonia volatilization is governed by the partial pressure of ammonia at the soil surface, manures high in NH_4^+, such as chicken manure may be subjected to lose ammonia at a correspondingly high rate. Moreover, Vervoot *et al.*, (1998) found that composting chicken manure litter reduced runoff and leaching of N, but did not reduce soluble P levels in surface and subsurface runoff. Composting organic wastes does not reduce K availability when compared to fertilizer K (Wen *et al.*, 1997). On the other hand, Warman and Cooper, (2000) showed that compost and chicken manure amendments may reduce crop yields compared with NPK fertilization due to limited nutrient availability, but soil reserves of N, P and K (and other nutrients) will be increased after repeated amendment applications. Mineralization and/or release of these sorted nutrients should result in improvements in crop yields in subsequent years and the gradual reduction in future application of manure or compost.

Wang *et al.*, (2002) indicated that the livestock waste composts could lead to a high nitrate content in deeper soil layer of the early stage after compost application and increasing the risk of nitrate pollution in underground water through leaching in summer. High NH_3 volatilization rates may occur in the few hours following land application of organic manure, (Gordon *et al.*, 2001).

Conditions that affect NH_3 volatilization include soil physical and chemical properties, temperature and moisture regime, (Hargrove, 1988). N' Dayegamiye *et al.*, (1997) studied five kinds of manure composts and found that most of them experienced an initial period of fast N mineralization until labile N forms from microbial products were exhausted, followed by a period of slow N mineralization due to their high content of more stable N forms. This characteristic of compost and manures makes them appropriate for crops requiring a low, steady rate of N applied throughout the growing season.

Soil characteristics, such as pH and nitrification activity, also affect volatilization. In other word, soil pH in the range of 6 to 8 could influence nitrification rates in soils. The pH of artificial growth media is known to strongly influence the activity of nitrifying microorganisms, with maximum growth at pH values in the range of 7.5 to 8.2 (Norton, 2000).

Rainfall on wet soil usually decrease volatilization by (1) diluting surface NH_4^+, thereby reducing NH_3 partial pressure, and (2) transporting NH_4^+ deeper into the soil, thereby increasing resistance to volatilization (Whitebead and Raistrick, 1991). A large percentage of the N in manure is lost, through NH_3 volatilization from animal housing, manure storage facilities, during and after manure application. Several studied, which have focused on the factors effect NH_3 emission rates, have observed losses to be influenced by the NH_3 partial pressure gradient between the manure surface and the air above by the wetting and drying of manure, air temperature, soil and manure pH and method of application (Sommer and Olesen, 2000). The relationship between NH_3 volatilization and concentration of NH_3 in the applied manure appears to dominate environmental effects immediately after field application (Brunke *et al.*, 1988).

This study was undertaken to compare the effects of three nutrient sources: a compost made from fresh chicken manure and rice straw, fresh chicken manure, and mineral NPK fertilizer on crop yield, soil nutrients content, maize and wheat tissues nutrient content and dynamic changes of available nitrogen in soil .

MATERIALS AND METHODS

Two successive field experiments were carried out at Ismailia Agriculture Research Station during summer season 2002 with maize (Zea mays L., cv Skha 68) and winter season 2002/2003 with wheat (Triticum aestivum L., cv Giza 168). Some physical and chemical characteristics of the studied soil are shown in Table 1.

Each plot was 3 x 3.5 m^2, a randomized complete block design with three replications was used under sprinkler irrigation system. In this experiment three sources of nitrogen were used: ammonium sulfate $(NH_4)_2\ SO_4$ as inorganic N source (MF) composted chicken manure (CCM) and fresh chicken manure (FCM) as organic nitrogen sources. Treatments were applied alone or mixed, at different ratios, i.e., inorganic100%, inorganic 75%+organic25%, inorganic50% + organic50%, inorganic25% +organic75% and organic100%, 4:0, 3:1, 2:2, 1:3 and 0:4, respectively.

These ratios were calculated based on the recommendations for N fertilization of maize, (120 unit N/ fed.) and wheat (100 unit N/fed.). The analysis of compost chicken manure (CCM) and fresh chicken manure (FCM) are shown in Table 2.

Table (1): Some physical and chemical characteristics of the experimental soil

Particle size distribution %	
Sand	84.76
Silt	9.24
Clay	6.0
Texture	Sand
Chemical properties	
$CaCO_3$ %	2.4
pH (1:2.5 soil -water suspension)	7.68
EC dS/m (at 1:5 soil -water extract)	0.52
Organic matter %	0.37
Available nutrients ($mg.g^{-1}$)	
NH_4- N	14.3
NO_3- N	2.6
Phosphorus (P_2O_5)	17.21
Potassium (K_2O)	73.43

Table (2): some characteristics of chicken manure and compost.

Determination	**Fresh chicken manure (FCM)**	**Composted chicken manure (CCM)**
EC (1:10)	7.08	6.11
pH (1:10)	8.3	7.60
C/N ratio	20.54	16.98
NH_4 _N content ($mg.g^{-1}$)	376	98
NO_3_ N content ($mg.g^{-1}$)	59	0.53
Total macro-nutrients (%)		
phosphorus	1.70	1.23
Potassium	2.23	2.45

Organic manure was spread over the plots and thoroughly incorporated into the top 20 cm soil layer, 2 weeks before planting. The soil was slightly irritated to stabiles good microbial activity for decomposing organic residues in suitable time before sowing maize (first season), while, in the second season experiment was carried out to evaluate the residual effect of nitrogen in soil.

Ammonium sulfate was divided into two equal doses; the first was practiced at the sowing and the second being applied after 35 days from sowing of maize (vegetative stage). All treatments received phosphorus a rate of 150 kg fed. $^{-1}$ superphosphate (15.5 %P_2O_5) and potassium at 100 kg fed. $^{-1}$ K_2SO_4 (48 % K_2O). The recommended practices of cultivation were applied till crop maturity. In the same plots wheat was planted after 15 days of maize harvesting. The same treatments of mineral fertilizers and common cultivation practices were applied up to maturity.

After maturity, maize and wheat plants were harvested. The grain weight and weight of 1000 grain of each plot were recorded. Samples of maize and wheat grains were collected from bulk plot yield, weighed, oven dried at 70°C, ground and prepared for digest. Also, nutrients N, P and K were determined according to Chapman and pratt (1961). Protein percent in the grain was calculated by multiplying N% by 5.75 according to A.O.A.C. (1980).

During the experimental period of both maize and wheat plants, soil samples were randomly collected from each treatment at the depth of 0-15, 15-30 and 30-45 cm after 15, 30 and 120 or 150 days from sowing of maize and wheat plants, respectively, to determine soil pH, moisture content and temperature which affected on the dynamic changes of available nitrogen according to Black (1965).

After harvesting, surface soil sample (0-15 cm depth) were taken and subjected to the following determination: EC, organic matter content and available P and K according to Black (1965).

Obtained results were subjected to Statistical analysis according to Snedecor and Cochran (1980) and the treatments were compared by using L.S.D. at 0.05 level of probability.

RESULTS AND DISCUSSION

Effect of organic nitrogen (composted and fresh chicken manure) and inorganic nitrogen on some soil characteristics after harvest of both maize and wheat plants.

Data in Table 3. show that the values representing EC was generally increased after harvest of both maize and wheat plants as compared to before cultivation. Similar trends being generally obtained with organic nitrogen treatments as compared to mineral fertilizer. Such increases were dependent, however, on the concerned treatments; mineral fertilizer 50 % (MF) + fresh chicken manure (FCM) 50 % was highest values after maize harvested and composted chicken manure (CCM) 100% treatment after wheat harvested. This increases could be attributed to release basic cations and ammonia during organic material decomposition (Pocknee and Sumner, 1997)

It may be worth to mention that values of EC values were slightly lower after wheat harvested than that of maize at all treatments. This lowering of soil salinity could be due to that the incorporation of organic substances into the soil creates a good conditions of drainage. Similar results were also obtained by Abou-Baker and Omar (1996).

Concerning soil organic matter content, data in Table 3. reveal that CCM and FCM were high in soil O.M after harvested of maize and wheat crops. In addition, treatments having organic manures were significantly increased as compared to MF treatment after harvested of two crops. Consequently, the incorporated of mineral fertilizers and fresh or composted chicken manure treatments were superior in organic matter content after maize and wheat harvesting, regardless of the rates as compared to MF treatment. Also, the incorporation of MF at 25% + CCM or FCM at rate of 75% was more effective as compared to other mixture treatments after maize and wheat harvested. Of course, variation of organic matter content in soil after wheat harvested was lower than after maize harvested presumable due to rapid oxidation and decomposition of organic matter as a result of microorganisms activity (Laila *et al.*, 2003).

Table (3): Effect of different nitrogen sources on some chemical properties of the soil studied after maize and wheat harvested.

Treatments	EC dS/cm	Organic matter %	Chemically available ($mg.g^{-1}$) P	K
First season (Maize)				
M F 100% (control)	0.93	0.29	36.00	109.89
M F 75% and CCM25%	1.33	0.40	90.40	131.20
M F 50% and CCM 50%	1.27	0.46	70.00	126.91
MF25% and CCM 75%	1.08	0.54	48.80	124.18
CCM100%	1.10	0.65	40.16	114.82
MF75% and FCM 25%	1.08	0.42	96.80	125.23
MF 50% and FCM 50%	1.62	0.48	84.40	132.35
MF 25% and FCM 75%	0.80	0.51	74.20	127.16
FCM 100%	1.13	0.61	59.60	121.84
L.S.D 5%	0.42	0.13	2.58	5.24
Second season (wheat)				
M F 100% (control)	0.80	0.23	15.87	78.82
M F 75% and CCM25%	0.62	0.31	20.93	92.75
M F 50% and CCM 50%	0.84	0.35	20.40	89.87
MF 25% and CCM 75%	0.90	0.42	17.87	91.67
CCM100%	1.00	0.45	17.07	75.99
MF 75% and FCM 25%	0.60	0.33	20.40	94.97
MF 50% and FCM 50%	0.73	0.39	22.40	97.48
MF 25% and FCM 75%	0.78	0.45	19.40	89.31
FCM 100%	0.75	0.48	18.80	82.60
L.S.D 5%	0.08	0.10	1.45	3.12

MF = Mineral fertilizer CCM= Composted chicken manure FCM= fresh chicken manure

With respect to chemically available phosphorus and potassium in soil after harvested of two crops (Table, 3) data indicated that, mixture of inorganic and organic fertilizers were effective positively and significantly on the available P and K as compared to addition these fertilizers separately. This could be attributed to organic acids resulting from the metabolic breakdown of organic materials form complexes with the inorganic phosphate and potassium. Thus, phosphorus is more readily available to higher plants. Similar results were obtained by El-Emam (1999) and Laila (2001). Consequently, the addition of MF75% +CCM 25% and MF 50% +FCM 50% were superior for available P and K as compared to other treatments after maize and wheat harvesting, respectively, as well as MF50% + FCM 50% was higher in soil after wheat harvesting for both P and K nutrients.

In sandy soil with low organic matter, K^+ can be leached. The application of composted manure to soil is one mechanism that is thought to reduce volatilization erosion leaching losses of nutrients. The composting of chicken manure can convert unstable material to a well-stabilized, humidified substance (Mondini *et al.*, 1996).

Nitrogen status in soil

Some factors which explain variation in nitrogen fluxes

Distribution of N through soil profile are influenced by several factors such as temperature, moisture content and pH in soil. Such factors were measured during the growth period of maize and wheat at the depths of 0-15cm, 15-30cm and 30-45cm) after 15,30 and 120 or 150 days from planting of maize and wheat, respectively, to explain variations in NH_3 fluxes.

With regard to soil temperature, during growth stages of maize and wheat crops, data in Table (4) indicated that mean values of soil temperature were fluctuated between 22.0 °C -30. 6 °C for maize and 16.0 °C -36.6 °C for wheat at different depths. Also, data reveal that soil temperature decreased with depth for two crops at different stages. Sommer and Olesen (2000) found that up to 50% of nitrogen losses from applied manures can occur within 3h. It has been suggested that manure spreading in the evening can reduce NH3 losses compared to mid-day spreading. It is postulated that mid-day applications result in increased losses due to higher temperatures.

Regarding soil moisture content, obtained values were generally low in maize growth (not more than 4.41); their average value was slightly affected with soil depth and with plant growth progress. Relatively different trend was encountered in wheat growth, such values were decreased with plant growth and increased with soil depth. This decrease may be due to high temperature of both soil and air which to increased evaporation (at summer season) . The slightly high soil moisture during growth of wheat plants (winter season) was probably due to water interception by the organic residues. This result confirmed by Whitead and Raistrick (1991) and Rochette *et al.*, (2001).

With respect to pH values of the studied soil samples, during the growth stages of both maize and wheat (Table (4)). They tended to be alkaline. They differed within range of 7.70 to 8.22 and although being generally higher in deeper profile layers. Increasing soil pH following organic manure addition can be partly attributed to the (1) adsorption of H^+ ions on the surface of the added organic materials, (2) development of reducing conditions due to increased microbial activity during rapid decomposition of the organic matter (3) displacement of hydroxyl from sesquioxide surface by organic anions (4) addition of basic cations and (5) production of NH_3 during decomposition (Pocknee and Sumner 1997). Moreover, during decomposition of organic matter release of CO_2 thus, the pH values increased due to increased of application the organic matter, which enhances of volatilization of nitrogen. Also, data reveal that pH values were almost stable, specially at the surface layer 0-15 cm., then to be slightly decreased through growth stages and after harvesting of two crops. Norton (2000) reported that nitrification rates in soils are little affected by soil pH. The pH strongly influenced the activity of nitrifying microorganisms with maximum growth at pH values in the range of 7.5 to 8.2, part of this effect may be due to the presence of bicarbonates may found at the higher pH values. Carbonates and bicarbonates can provide a source of CO_2 needed for growth of the autotrophic organisms involved. Also, Kyveryga *et al.*, (2004) showed that, the soil pH within the range of 6 to 8 must be considered an important factor affecting the risks and benefits associated with fall applications of anhydrous ammonia under climatic conditions found in the corn.

Table (4): Mean values of temperatures(°C), moisture content (%)and pH (values) in three depths of soil during growth stages for maize and wheat crops

Time of soil sampling	Crop					
	Maize crop			Wheat crop		
	*0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm
Average temperature (°C)						
After 15 days from planting	30.57	29.77	29.43	17.50	17.17	16.60
After 30 days from planting	28.73	28.2	27.70	16.93	16.12	16.01
**After harvesting	23.37	22.13	22.00	36.60	36.20	35.80
soil moisture content (%)						
After 15 days from planting	1.83	2.23	2.49	13.56	14.52	14.68
After 30 days from planting	2.99	3.62	4.41	10.29	12.25	12.86
**After harvesting	2.78	3.74	4.04	3.56	4.15	4.56
pH values						
After 15 days from planting	7.70	8.05	8.12	7.49	7.98	8.22
After 30 days from planting	7. 72	7.85	7.92	7.47	8.01	8.12
**After harvesting	7.72	7.82	7.95	7.50	7.95	8.12

*Depth of soil

* * After 120 and 150 days from planting for maize and wheat plants, respectively.

Mineralization and/or immobilization transformations of N in soil during decomposition of applied manures

Nitrogen mineralization and dynamic changes of NH_4^+ - N and NO_3^- - N in the soil layers could be influenced to a great extent by inorganic and organic N fertilization during growth stages of maize and wheat plants (Figs, 1 and 2). The concentration of available N initially increased for most of the amended soils treatments. It reached to the maximum values at 30 days after planting (DAP) and declined gradually with the advanced growth stages of maize until harvested (120 DAP). While, for wheat the available nitrogen (NH_4^+ and NO_3^-) was decreased gradually with the advanced growth stages of wheat until harvested (150 DAP). This is mainly attributed to repeated not of inorganic and organic fertilizers application in second season to study the residual effect.

Commonly, the content of ammonium is slightly high in upland (0-15 cm) soil because applied nitrogen in the form of $(NH_4)_2SO_4$ and decomposition of organic manures (composted chicken manure (CCM) or fresh chicken manure (FCM)) . Therefore, the changed in the content of ammonium through different layers (0-15, 15-30 and 30-45 cm) were less conspicuous in all the treatments throughout the growth stages of maize and wheat crops (Figs. 1 and 2). For example, ammonium N content in 30-45 cm soil layer after 120days from planting of maize crop, was only 17.02 $mg.g^{-1}$ after application of mineral fertilizer (MF)100%, while it was 188.67 $mg.g^{-1}$ due to application of MF75%+FCM25% in 0-15 cm after 30 days from planting of maize crop. In the second season it was 9.33 $mg.g^{-1}$ after application of MF100% in 30-45 cm soil layer after 150days from planting of wheat crop, while, it was 73.83 $mg.g^{-1}$after application of MF75%+FCm25% in 15-30cm after 15 days from planting of wheat crop. These results indicated that, ammonium from ammonium sulfate ($(NH_4)_2SO_4$) as inorganic N source was easily transformed to nitrate in the surface layer which may result in under ground water pollution or in a decrease in the use efficiency of N fertilizers due to the leaching of nitrate N to deeper layers of soil.. Since the nutrient contents and the nutrient release from organic manures are relatively low, so, total or partial substitution of chemical fertilizer N by the application of organic manures, such as composted of animal wastes, may decrease the pollution of nitrate in underground water(Hakamata and Hirata, 1997).

Generally, soil NH_4 –N content which was high in surface layer then gradually decreased as the depth of soil increased, while, soil NO_3 -N content was decreased as the depth of soil increased (Figs., 1and 2). The depletion in available soil N with continuous cropping is mainly attributed to uptake by plants. In addition to N losses through different mechanisms particularly N leaching below the root zone which actively took place in such light textured soils. Data illustrated in Figs., 1 and 2 show that, the nitrate content in the layer (0-15cm) of soil was slight lower than other depths during the experiment period under in this all treatments. For example, nitrate content in 0-15 cm of soil layer, was11.54 $mg.g^{-1}$and153.33 $mg.g^{-1}$after application of MF 100% after 15 days from planting of maize crop and after application of mineral fertilizer (MF)75%+ fresh chicken manure (FCM) 25% after30 days from planting of maize crop, respectively. While, it was 4.63 and 58.83 ppm in same soil layer after application of MF50% + (CCM) 50 % and MF75%+ FCM25% after 150 and 15 days from planting of wheat crop, respectively.

Also, the results showed that nitrate content was high at the early stage of growth after the application of fresh or composted chicken manure (CCM) treatments, presumably due to the large amount of N released from the organic manures and low absorption of nutrients by plants. On the other hand, nitrification of NH_4^+ has been found to occur rapidly after spreading of organic manure, (Wang *et al.*, 2002) . Maximum NO_3^- content was recorded after 30 and /or 15days from planting of maize and wheat crops, respectively. The treatments are ranked as follows: MF 50% +FCM50% > MF 25% + FCM75% > MF75%+ CCM 25% > MF50%+CCM50%> MF 100% > MF75%+FCM25% >MF25%+ CCM75%> FCM 100%> CCM100%.

After the first month from planting, except for organic N sources had high positive effects on the soil NH_4^+ -N and NO_3^- -N concentrations as compared to inorganic N and this trend persisted till crop was harvested. A difference among the organic N sources was obtained in there effects on the availability of soil N (NH_4^+ and NO_3^-) where it was higher in CCM compared to FCM. The results also, show that available soil N increased gradually with the increase of the applying rate of inorganic N compared to organic N in their mixtures. This effect was true and more pronounced for all organic N sources. On the other hand, the underlying assumption is that nitrification is strongly inhibited by low temperatures during winter months (wheat season), so fertilization in late fall instead of early spring does not significantly increase the potential for losses of the fertilizer N by leaching or denitrification of NO_3^- when excess water is present during the fall-through-spring period, (Kyveryge *et al.*, 2004). Also, the nitrification process increase with increasing of temperature, thus the ammonium content is easily transformed to nitrate. Denitrification of NO_3^- is also unplausible in this coarse-textured soil because soil water content was generally low during the experiment, data in Table 4. show Finally, nitrate leaching to lower soil depths may also have contributed to the apparent imbalance between NH_4^+ disappearance and NO_3^- production.

From the above mentioned results it is quite clear that, the combined application of organic N with inorganic N in their mixtures caused positive effect on available N- NH_4^+ and NO_3^- as comparison to the values obtained when they were added separately. For example, the mixing rate of MF 50% + CCM or FCM 50% has a clear effect on nitrogen mineralization as compared to the other mixing ratios, except in compost amended soils where the mixing ratio of 3:1 was found to be superior. Therefore, application of such composted and/or fresh chicken manure along with chemical fertilizer may be helpful in conserving the fertilizer N and in assuring its continued availability to subsequent crops. Since microbial biomass is a potentially available N source whereas humic compounds may prove to be an important source of N supply over an extended period of time (Azam *et al.*, 1985). Soil NH_4 content was drastically increased by organic manure addition. However, this effect was short lived since soil NH_4^+ content returned to background levels 10d after manure addition. In the absence of N uptake by plants. The NH_4^+ disappearance can be explained by NH_3 volatilization, nitrification or immobilization, (Chantigny, *et al.*, 2001). Ammonia volatilization was likely small in our case, because the organic manure was incorporated at 10 cm depth which strongly reduces volatilization.

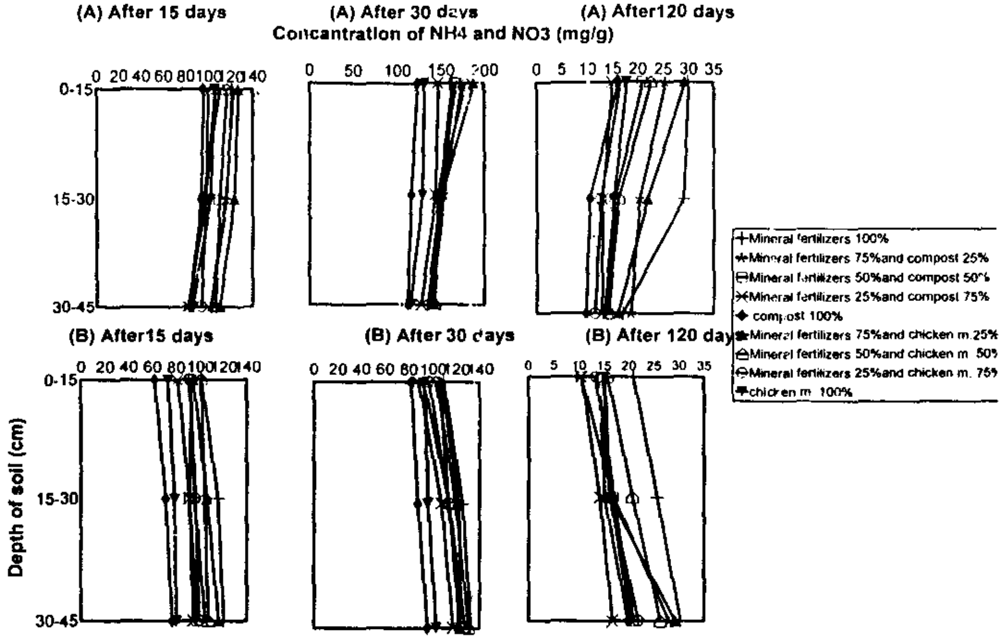

Fig. 1: Effect of application fresh and composted chicken manures on (A) NH4-N (mg/g) and (B) NO3-N contents duringmaize season

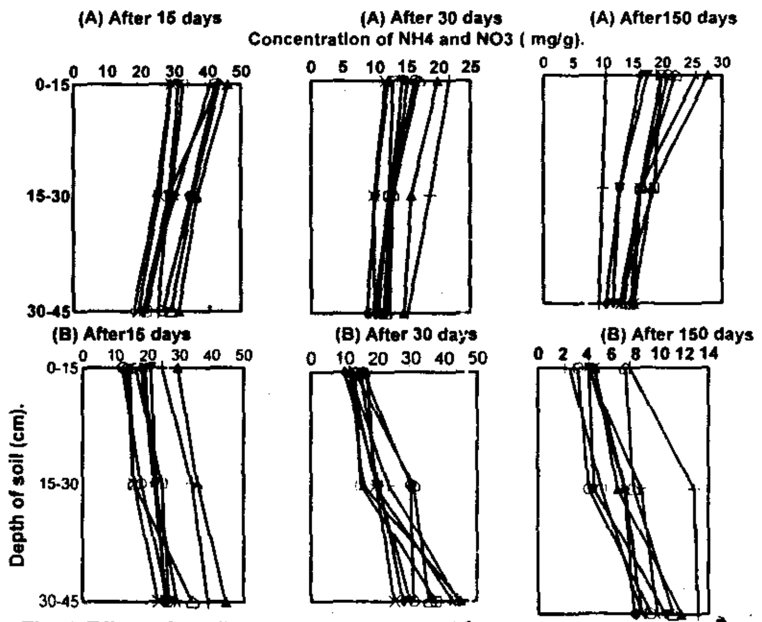

Fig. 2 Effect of application composted and fresh chicken manures and mineral fertilizer or (A) NH4-N (mg/g) and (B) NO3-N (mg/g) contents duringwheat season

Response of maize and wheat to different nitrogen sources.

a. Yields of maize and wheat

As shown in Table (5) maize yield and weight of 1000 grain were, generally, increased significantly with application of inorganic and organic nitrogen mixture. These increments were significant compared to mineral nitrogen (MF) or organic nitrogen (CCM or FCM) alone. The residual effect on these treatments on wheat grain yield show the same trend of the direct effect on maize grains. Application of MF 75% + FCM 25% was generally superior in grain yields of maize and wheat as compared to the other treatments. However, this increase reach to 15.24 % for maize and 38.79% for wheat . Obtained data agree with Metwally, (1994) and EL- Emam, (1999) who mentioned that, the mixture of nitrogen sources (inorganic and organic) fertilizer were superior than application of an organic or mineral fertilizer from singly .

Table (5): Maize and wheat yields and weight of 1000 grains as affected by application of fresh and composted chicken manures and mineral fertilizer.

Treatments	Yield Ard/fed	Increase %	Weight of 1000 grains	Increase %
First season (maize)				
Mineral fertilizers 100% (control)	18.70	0	308.40	0
Mineral fertilizers 75% and compost 25%	20.32	8.66	333.33	8.08
Mineral fertilizers 50% and compost 50%	19.78	5.77	311.57	1.03
Mineral fertilizers 25% and compost 75%	18.78	0.92	311.32	0.95
Compost 100%	18.10	-3.21	307.67	-0.24
Mineral fertilizers 75% and fresh chicken m. 25%	21.55	15.24	341.00	10.57
Mineral fertilizers 50% and fresh chicken m. 50%	20.61	10.21	337.70	9.5
Mineral fertilizers 25% and fresh chicken m.75%	19.35	3.47	319.50	3.59
Chicken manure 100%	18.51	-1.01	318.90	3.4
L.S.D 5%	1.03	-	0.76	-
Second season (Wheat)				
Mineral fertilizers 100% (control)	9.82	0	48.03	0
Mineral fertilizers 75% and compost 25%	12.01	22.30	49.33	2.71
Mineral fertilizers 50% and compost 50%	11.69	19.04	48.27	0.49
Mineral fertilizers 25% and compost 75%	10.76	9.57	47.03	-2.12
Compost 100%	9.45	-3.77	46.40	-3.39
Mineral fertilizers 75% and fresh chicken m. 25%	13.63	38.79	50.77	5.70
Mineral fertilizers 50% and fresh chicken m. 50%	12.77	30.04	50.05	4.21
Mineral fertilizers 25% and fresh chicken m.75%	11.95	21.17	48.67	1.33
fresh chicken manure 100%	10.20	3.86	48.50	0.97
L.S.D 5%	1.12	-	0.69	-

b. Nutrients content (N,P and K) and crude protein.

Data in Table (6) indicate that, N,P and K concentration and crude protein in both maize and wheat were, (1) maximized under treatments of 75% mineral N fertilizer and 25% fresh chicken manure (2) the entire application of N in the mineral form did not differ significantly from the 3:1 mixture of inorganic : organic N treatments under both crops and thus both treatments could be ranked of the same order as a stimulators for N,P and K concentrations. Generally, significantly increased with the mixture of nitrogen sources (inorganic and organic forms). However, the incorporated of mineral fertilizer with composted (CCM) or fresh chicken manures (FCM) at different ratios positively affected nutrients content and crude protein of both maize and wheat plants. Also, applied nitrogen sources at ratio of MF 75% + CCM or FCM 25% and MF 50% + CCM or FCM 50% were better than other mixture treatments as compared to application of the organic form only. These results show that the application of 75% organic N form and the rest in the mineral form ($(NH_4)_2SO_4$) produce almost the same yield approximately as in the case of 100% organic N sources (CCM or FCM). On the other hand, chemical fertilizers of N supplied a greater proportion of nutrients concentration in maize and wheat crops than any organic N when applied alone . This mean that, N requirements of maize and wheat crops in sandy soil can not be met by the separate applications of any organic N examined . Therefore, these finding made it clear that even with organic N application, a chemical N fertilizer such as ammonium sulfate Metwally (1994) and El – Emam (1999) confirmed these results.

Table (6): Effect of different sources of nitrogen on some nutrient concentrations in maize and wheat crops

Treatments	Concentration %			Crude protein
	N	P	K	
First season (Maize)				
Mineral fertilizers 100% (control)	3.17	0.64	1.26	18.23
Mineral fertilizers 75% and compost 25%	3.12	0.58	1.38	17.94
Mineral fertilizers 50% and compost 50%	3.01	0.63	1.10	17.31
Mineral fertilizers 25% and compost 75%	2.53	0.57	0.96	13.39
Compost 100%	2.19	0.55	1.33	12.59
Mineral fertilizers 75% and fresh chicken m. 25%	3.23	0.58	1.30	18.57
Mineral fertilizers 50% and fresh chicken m. 50%	3.17	0.60	1.57	18.23
Mineral fertilizers 25% and fresh chicken m.75%	2.81	0.52	1.17	16.16
fresh chicken manure 100%	2.46	0.55	1.41	14.15
L.S.D 5%	0.68	0.05	0.25	1.27
Second season (Wheat)				
Mineral fertilizers 100% (control)	3.02	0.35	1.94	17.36
Mineral fertilizers 75% and compost 25%	2.74	0.42	1.69	15.76
Mineral fertilizers 50% and compost 50%	2.69	0.39	1.64	15.47
Mineral fertilizers 25% and compost 75%	2.22	0.39	1.55	12.76
Compost 100%	1.87	0.34	1.44	10.75
Mineral fertilizers 75% and fresh chicken m. 25%	3.06	0.52	1.96	17.59
Mineral fertilizers 50% and fresh chicken m. 50%	2.85	0.47	1.74	16.39
Mineral fertilizers 25% and fresh chicken m.75%	2.27	0.47	1.59	13.05
fresh chicken manure 100%	2.12	0.39	1.48	12.19
L.S.D 5%	0.21	0.12	0.28	1.01

Also, the results indicate that, the N,P and K concentrations and crude protein in wheat grains were lower than maize grains at any mixture ratios application (inorganic : organic). It could be attributed to that the N,P and K release from the organic manures mainly occurred in the first month after application (Wang *et al.*, 2001) . Some of the released nutrients from the organic manure may have leached into the deep soil layers before wheat plants which absorb a large amount of nutrients, thus leading to a low use efficiency of nutrients, especially nitrogen released from the organic manure by wheat plants.

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التغيرات في محتوى النتروجين في طبقات الأرض المختلفة بعد إضافة سماد الدواجن المتخمر أو الرطب و النتروجين المعدني أثناء زراعة الذرة والقمح في الأراضي الرملية.

ليلى قرني محمد على
معهد بحوث الأراضي و المياه والبيئة – مركز البحوث الزراعية

في تجربة حقلية تضمنت موسمين زراعيين لمقارنة تأثير التسميد بسماد الدواجن المكمور مع خليط من قش الأرز و الرطب كمصدر نتروجين عضوي و سلفات الأمونيوم كمصدر معدني. أضيفت الأسمدة في مخاليط من المصدر المعدني والعضوي بنسب ١٠٠% تسميد معدني،٧٥%تسميد معدني+٢٥% تسميد عضوي، ٥٠% تسميد معدني +٥٠% تسميد عضوي ، ٢٥% تسميد معدني + ٧٥% تسميد عضوي و ١٠٠% تسميد عضوي، حيث أضيف النتروجين بالمعدل الموصى به ١٢٠ و ١٠٠كجم ن /فدان لنبات الذرة والقمح على التوالي في جميع القطع التجريبية.

قدرت خواص مختلفة لتقيم قدرة سماد الدواجن الرطب والمكمور «Composted» على إمداد نبات الذرة والقمح النامي في الأراضي الرملية باحتياجه من عنصر النتروجين.

من الخواص الكيميائية المقدرة: التوصيل الكهربائى ,EC محتوى الأرض من المادة العضوية و المحتوى الميسر من الفوسفور والبوتاسيوم.

كما درست التغيرات في محتوى النتروجين خلال ثلاثة أعماق من الأرض ٠–١٥ سم، ١٥–٣٠سم و٣٠–٤٥ سم وذلك أثناء مراحل نمو كل من الذرة والقمح بعد ١٥، ٣٠ و ١٢٠و١٥٠ يوم من زراعة الذرة والقمح على الترتيب. قدر لذلك درجة حرارة الأرض و الأس الهيدروجيني (pH) ومحتوى الماء الأرضي و تأثير ذلك على محتوى الأرض من النتروجين الأمونيومى والنتراتى على نفس الأعماق.

وقد وجد أن اتحاد المصدر النيتروجيني المعدني والعضوي أدى الى زيادة قيم pH ، المادة العضوية والمحتوى الميسر من الفوسفور والبوتاسيوم في الأرض. بينما انخفضت قيم الـEC وذلك بعد حصاد كل من الذرة والقمح. وكانت أكثر المعاملات تأثيرا عند خلط المصدر المعدني بنسبة٧٥% و سماد الدواجن بنسبة ٢٥% وكذلك خلط السماد المعدني وسماد الدواجن الرطب بنسبة ٥٠ %لكل منهما، باستثناء محتوى الأرض من المادة العضوية فقد زاد بزيادة معدل أضافه المصدر العضوي مقارنة بالمعاملات الأخرى. أضافه كل المعاملات أحدثت زيادة جوهرية في النتروجين الميسر في الأرض لوجود النتروجين المعدني. بينما انطلاق الأمونيوم و النترات من المصادر العضوية كان بطيء ويحتاج وقت أطول.

أوضحت الدراسة أيضا أن اندماج المصدرين المعدني والعضوي للنتروجين أدى إلى زيادة انطلاق للنتروجين الأمونيومي والنتراتي أكثر من إضافة كل منهما بمفرده خاصة بعد ٣٠ يوم من الزراعة.

كما زاد محصولي الذرة والقمح وتركيز كل من N, P and K ومحتوى البروتين بزيادة نسبة اتحاد المصدر المعدني والعضوي. أيضا إضافة المصدر العضوي بنسبة ٧٥% سواء سماد دواجن رطب أو متخمر و تكملة الاحتياجات النتروجينية بالمعدني يعطي نفس المحصول في حالة إضافة المصدر العضوي فقط بنسبة ١٠٠%.